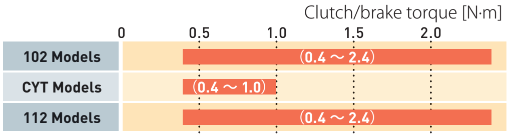
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES



Application Automated teller machines, sorters, office equipment, weighing and packaging machinery, printing machinery, bookbinding machinery, optical equipment

Micro Clutches and Micro Brakes for Precise Control of Compact Precision Equipment

These micro clutches and micro brakes are ideal for compact precision equipment where variations in torque and response must be avoided, such as office equipment, communication equipment, and automobiles. In addition to the 102 (clutch) and 112 (brake) models, which share the same basic clutch/brake design, we also provide CYT models (clutches), which can be customized into a wide variety of types to meet customer needs.

Available Models

Series	Applications	Lineup
MICRO CLUTCHES & BRAKES	Micro clutches	102
	Custom micro clutches	CYT
	Micro brakes	112

For details on selection, see P.308 to 315.

Micro Clutches

102-☐-☐☐

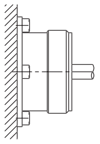
Size
Mounting
Shaft coupling system (armature)

Mounting

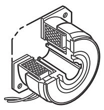
102-☐-1☐

Wall-mounted type

Uses a flange-mounted stator. Designed to be short in the axial direction, requiring less installation space.



Directly mounted to the wall

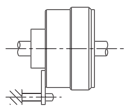


Flange-mounted type

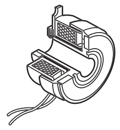
102-☐-3☐, CYT

Shaft-mounted type

Uses a bearing-mounted stator. Designed to be relatively easy to mount, reducing the processing and work required for mounting.



Mounted onto the shaft



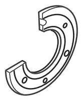
Bearing-mounted type

Shaft coupling system (armatures)

102-☐-☐3

Butt and parallel shaft type (Armature type-3)

These incorporate non-armature parts provided by the customer such as V pulleys, enabling use in designs that use either butt shafts or through-shafts.

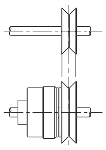


Armature type-3

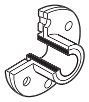
102-☐-☐5

Directly coupled type wound around the parallel axis (armature type-5)

Uses an armature assembly designed for use with through-shafts. Ensures that mounting is relatively easy to complete as well as extremely efficient in its approach.



Directly coupled by being wound around the parallel shaft

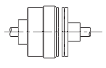


Armature type-5

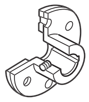
102-☐-☐1

Butt type (Armature type-1)

Uses an armature assembly designed for use with butt shafts. May be difficult to mount due to the need for centering and other adjustments, may require the use of a fitting flange, or may require use in combination with flexible couplings.



Coupled directly to the butt shaft



Armature type-1

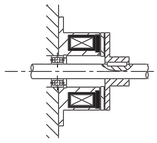
Micro Brakes

112-☐-1☐

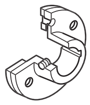
Size
Shaft Coupling System (Armature)

Shaft-mounted type

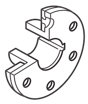
These use axial braking in most cases, the effectiveness of which depends on how efficiently parts are mounted.



Mounted to the shaft



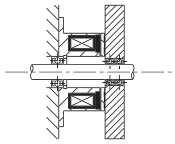
Armature type-1



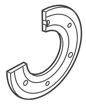
Armature type-2

Rotor-mounted type

Uses an armature assembly mounted directly to an inertial body not fastened to the shaft that continues to move even after the shaft has stopped.



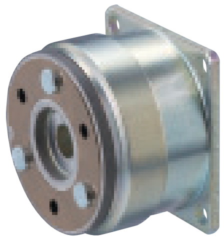
Mounted to the rotor



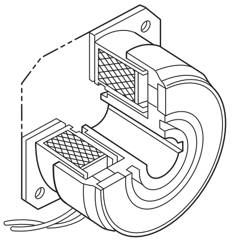
Armature type-3

Product Lineup

102-□-1□ Electromagnetic-actuated Micro Clutches - Flange-mounted Type



RoHS-compliant

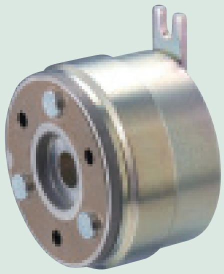


Flange-mounted type

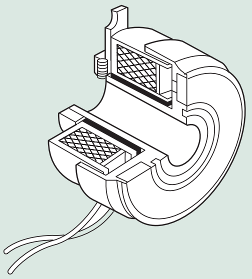
Stator and rotor are combined and directly mounted on stationary parts, such as frames, and fixed in place. These are short in the axial direction and can use space near walls effectively. Select the armature according to the coupling type used (through-shaft, butt shaft, etc.).

Clutch torque	[N·m]	0.4～2.4
Operating temperature	[℃]	－10～＋40
Backlash		Zero

102-□-3□ Electromagnetic-actuated Micro Clutches - Bearing-mounted Type



RoHS-compliant



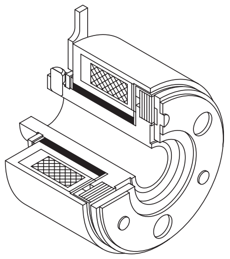
Bearing-mounted type

These integrate the stator and rotor, which are held to the stationary parts of the machine by a drive pin arm; the rotor is locked to the rotation shaft by a set screw. They are designed to be relatively easy to mount, reducing the processing work required for mounting. Select the armature according to the coupling type used (through-shaft, butt shaft, etc.).

Clutch torque	[N·m]	0.4～2.4
Operating temperature	[℃]	－10～＋40
Backlash		Zero

CYT Electromagnetic-actuated Micro Clutches - Custom Type

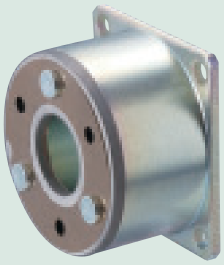
RoHS-compliant



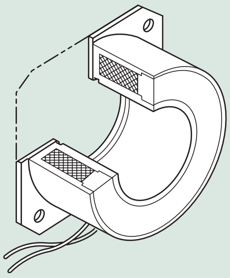
The CYT models are the basic building blocks for customized micro-clutches. The basic model is bearing mounted. Two types are available for different shaft rotation speeds: a dry metal type and a ball bearing type. Armature type-3 is standard, but many customizations are possible.

Clutch torque	[N·m]	0.4～1.0
Operating temperature	[℃]	－10～＋40
Backlash		Zero

112 Electromagnetic-actuated Micro Brakes



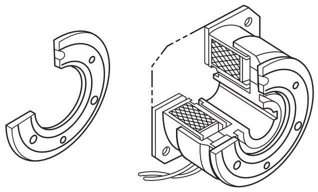
RoHS-compliant (except size #02)



Brakes are used to brake and hold rotating bodies. The flange of the stator is locked securely to a strong stationary part. Select an armature that factors in the mounting space available.

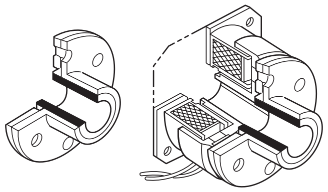
Brake torque	[N·m]	0.4～2.4
Operating temperature	[℃]	－10～＋40
Backlash		Zero

Types for through-shaft or butt shaft



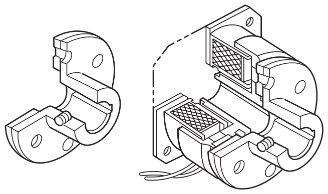
Armature type-3 102-☐-13

Through-shaft (coupled by winding around parallel shaft) type



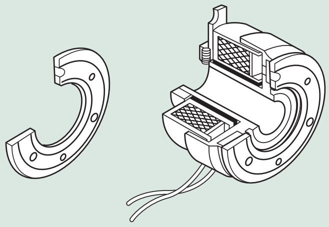
Armature type-5 102-☐-15

Butt shaft type



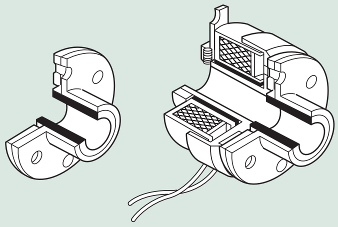
Armature type-1 102-☐-11

Types for through-shaft or butt shaft



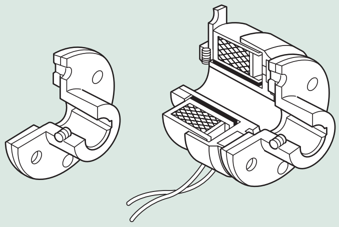
Armature type-3 102-☐-33

Through-shaft (coupled by winding around parallel shaft) type



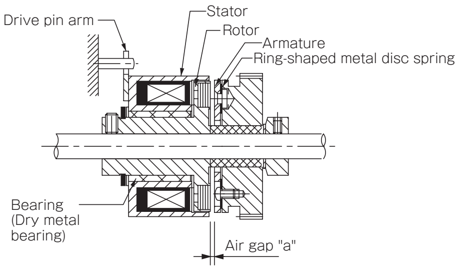
Armature type-5 102-☐-35

Butt shaft type



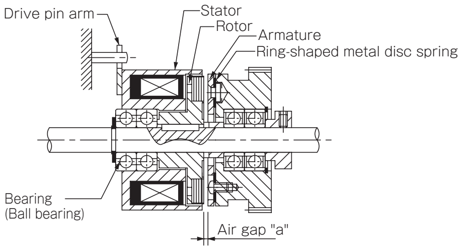
Armature type-1 102-☐-31

Dry metal type



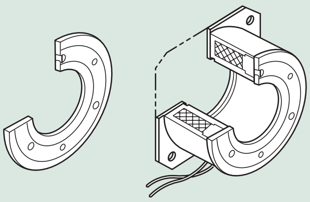
CYT-☐-33M

Ball bearing type



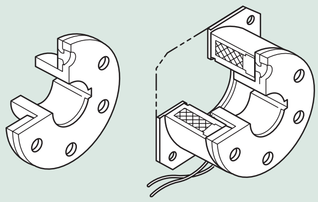
CYT-☐-33B

Types with many applications



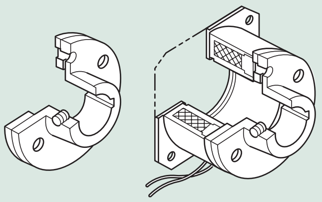
Armature type-3 112-☐-13

Slim, space-saving type



Armature type-2 112-☐-12

Easy-to-use standard-shape type

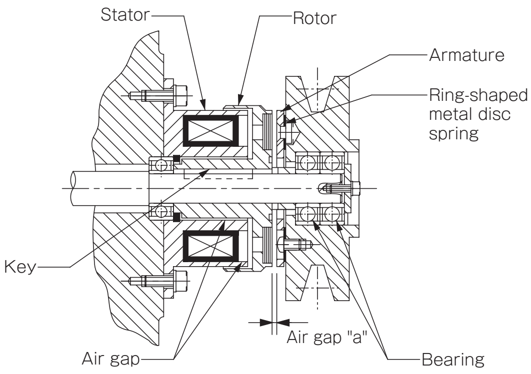


Armature type-1 112-☐-11

Mounting and CYT Customization Examples

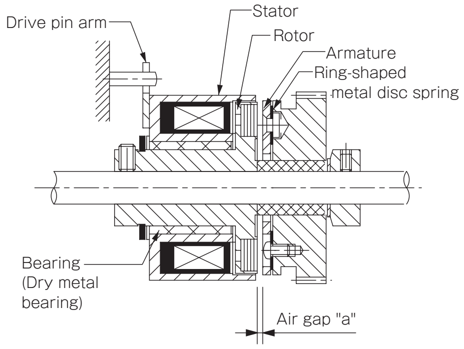
Flange-mounting example with 102

The stator is directly mounted on a stationary part, such as a frame, by a mounting flange, and fixed in place. The rotor is locked to the rotation shaft using a key. The stator and rotor are combined via a narrow air gap that serves as part of the magnetic circuit to form a magnetic pole.



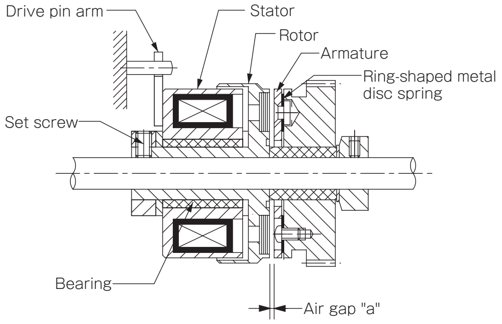
Dry-metal type mounting example with CYT

The stator is integrated with the rotor via dry metal, and held to the stationary parts of the machine by a drive pin arm. The rotor is locked to the rotation shaft using a set screw. The stator and rotor form a magnetic pole via the dry metal.



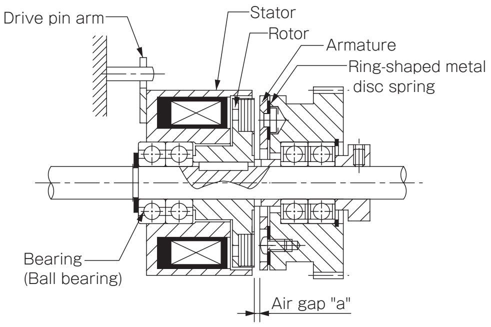
Bearing-mounting example with 102.

The stator is integrated with the rotor via a bearing and held to the stationary parts of the machine by a drive pin arm. The rotor is locked to the rotation shaft using a set screw. The stator and rotor form a magnetic pole via the bearing (ferrous oil-impregnated metal).



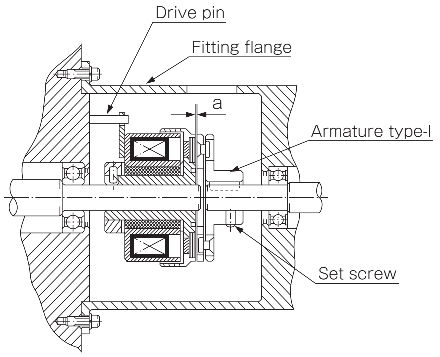
Ball-bearing type mounting example with CYT

The stator is mounted on the shaft via a bearing and held to the stationary parts of the machine by a drive pin arm. The stator and rotor are combined via a narrow air gap that serves as part of the magnetic circuit to form a magnetic pole.



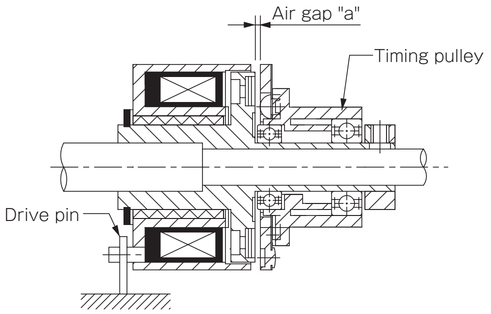
Butt shaft mounting example with 102

In designs that use butt shafts, the two shafts can be reliably centered using fitting flanges, as shown in the figure.



Dry-metal type embedding example with CYT

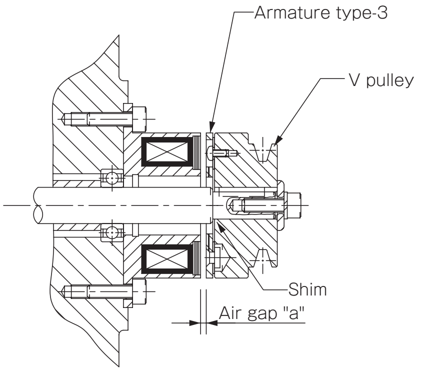
We design to your requirements using timing pulleys, gears and the like mounted on armature type-3.



Mounting and CYT Customization Examples

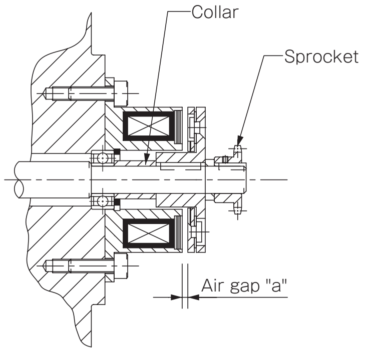
Armature type-3 mounting example with 112

Armature type-3 is used by directly mounting it to a transmission element such as a V-pulley or to a rotating body that stops inertial force.
The shaft of the brake part requires no processing. The shaft diameter may also be determined freely. Air gap "a" can be set easily using collars and shims. Corrections are easily accomplished by adding or removing shims.



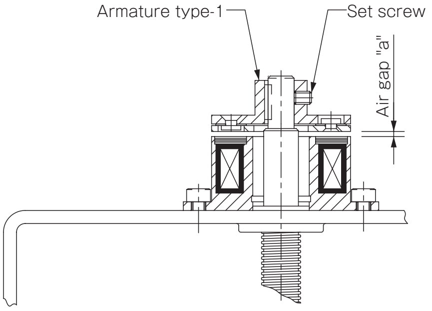
Armature type-2 mounting example with 112

Armature type-2 has the smallest mounting-space footprint of any of the armatures, so overhang is not a concern even when a sprocket or the like is mounted on the brake tip.
Air gap "a" can be set easily using collars and shims.
Corrections are easily accomplished by adding or removing shims.



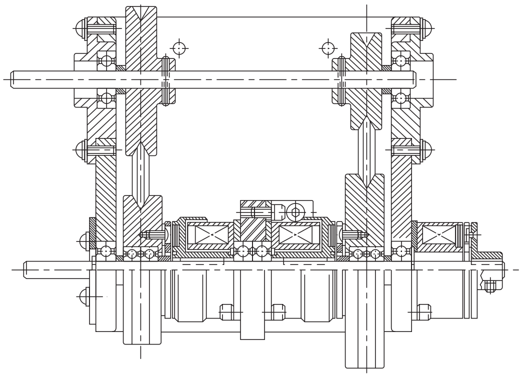
Armature type-1 mounting example on vertical shaft with 112

Since there is no restriction on mounting direction, there is no running torque or abnormal wear even when mounted on vertical shafts.
It is easy to set air gap a: simply move armature type-1 and lock it in place with a set screw.



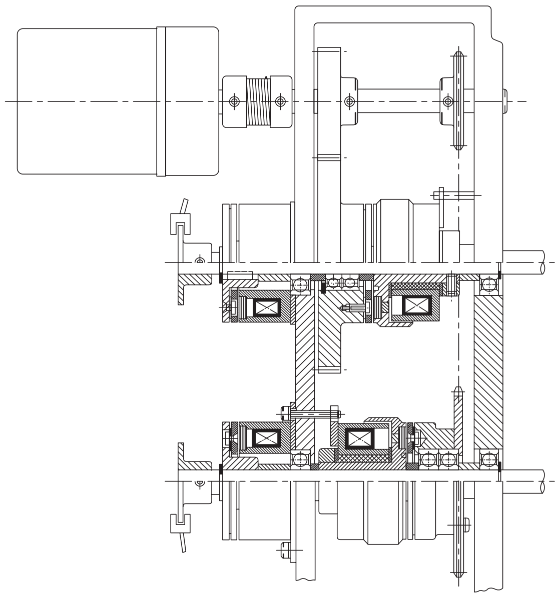
Example of the combination of clutches and brakes

This example uses a two-step speed-change mechanism combining two clutches and a brake.



Example of the combination of clutches and brakes

Shaft drive is both forward and reverse in combination with a clutch in this example. Start and stop freely by mounting brakes on each shaft.



102-□-1□ Types Electromagnetic Micro Clutches - Flange-mounted Type

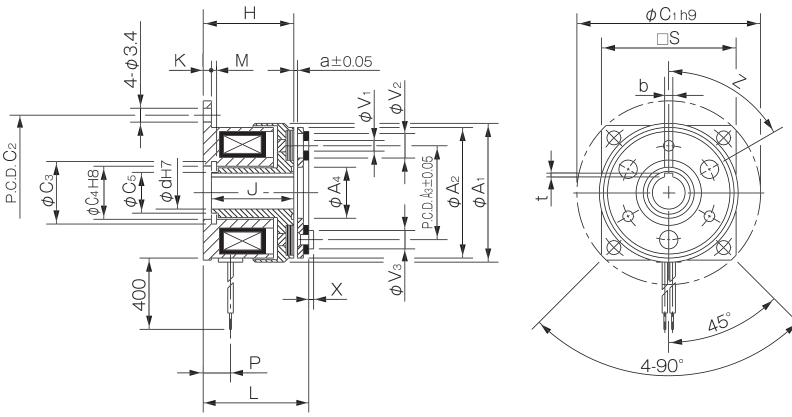
Specifications

Model	Size	Dynamic friction torque Td [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J		Allowable engaging energy Eeaℓ [J]	Total work performed until readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque rise time tp [s]	Torque extinction time td [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			Armature [kg·m²]	Rotor [kg·m²]						
102-02-13	02	0.4	DC24	6	0.25	96	B	10000	6.75×10^{-7}	2.45×10^{-6}	1500	2×10^{6}	0.009	0.019	0.017	0.075
102-02-15								500	1.00×10^{-6}							0.081
102-02-11								10000	1.00×10^{-6}							0.079
102-03-13	03	0.6	DC24	6	0.25	96	B	10000	1.30×10^{-6}	3.25×10^{-6}	2300	3×10^{6}	0.009	0.022	0.020	0.096
102-03-15								500	1.95×10^{-6}							0.105
102-03-11								10000	1.95×10^{-6}							0.103
102-04-13	04	1.2	DC24	8	0.33	72	B	10000	4.38×10^{-6}	1.41×10^{-5}	4500	6×10^{6}	0.011	0.028	0.030	0.178
102-04-15								500	6.15×10^{-6}							0.195
102-04-11								10000	6.15×10^{-6}							0.191
102-05-13	05	2.4	DC24	10	0.42	58	B	10000	9.08×10^{-6}	3.15×10^{-5}	9000	9×10^{6}	0.012	0.031	0.040	0.310
102-05-15								500	1.38×10^{-5}							0.335
102-05-11								10000	1.38×10^{-5}							0.325

* The dynamic friction torque, Td, is measured at a relative speed of 100 min⁻¹.
* The moment of inertia of a rotating body and mass are measured for the maximum bore diameter.
* Keep supply voltage fluctuation to within 10% of coil voltage.

Dimensions (102-□-13)

(For direct mounting)



Unit [mm]

Size	Shaft bore dimensions				
	d₁ H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
		b P9	t	b E9	t
02	5	—	—		
03	6	2 $^{-0.006}_{-0.031}$	0.8 $^{+0.3}_{0}$		
04	8	2 $^{-0.006}_{-0.031}$	0.8 $^{+0.3}_{0}$		
	10	3 $^{-0.006}_{-0.031}$	1.2 $^{+0.3}_{0}$	4 $^{+0.050}_{+0.020}$	1.5 $^{+0.5}_{0}$
05	10	3 $^{-0.006}_{-0.031}$	1.2 $^{+0.3}_{0}$	4 $^{+0.050}_{+0.020}$	1.5 $^{+0.5}_{0}$
	15	5 $^{-0.012}_{-0.042}$	2 $^{+0.5}_{0}$	5 $^{+0.050}_{+0.020}$	2 $^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions														Axial direction dimensions							
	A_1	A_2	A_3	A_4	C_1	C_2	C_3	C_4	C_5	S	V_1	V_2	V_3	Z	H	J	K	L	P	M	a	X
02	31	28	19.5	10.5	39	33.5	11.4	11	8	—	2-2.1	2-5.3	2-4	4-90°	18	16.5	1.5	20.5	5	1.1	0.1	0.8
03	34	32	23	12.5	45	38	13.6	13	10	33	3-2.6	3-6	3-4.5	6-60°	22.2	20.2	2	24.5	6.7	1.3	0.15	1.2
04	43	40	30	18.5	54	47	20	19	15.5	41	3-3.1	3-6	3-5	6-60°	25.4	23.4	2	28.2	7	1.3	0.15	1.5
05	54	50	38	25.5	65	58	27.2	26	22	51	3-3.1	3-6.5	3-5.5	6-60°	28.1	26.1	2	31.3	8.2	1.5	0.2	1.5

* Size 02 is a rounded flange.
* The rotor of size 02 has no keyway. Lock it in place by press-fitting it onto the shaft or the like.

How to Place an Order

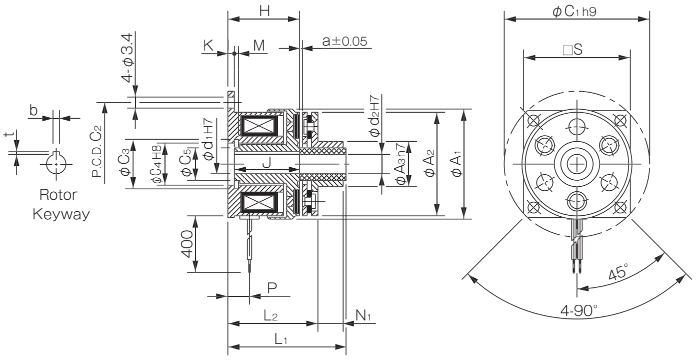
102-03-13 24V 6DIN

Size
Rotor bore diameter (dimensional symbol d)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

*Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

Dimensions (102-□-15)

(For through-shafts)



CAD

Unit [mm]

Size	Shaft bore dimensions					
	d₁ H7	d₂ H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
02	5	5	—	—		
03	6	6	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
04	8	8	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
05	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$

* The armature type-5 bore d₂ is a straight bore.

Unit [mm]

Size	Radial direction dimensions									Axial direction dimensions								
	A_1	A_2	A_3	C_1	C_2	C_3	C_4	C_5	S	H	J	K	L_1	L_2	M	P	N_1	a
02	31	28	13	39	33.5	11.4	11	8	—	18	16.5	1.5	27.5	22.4	1.1	5	4.8	0.1
03	34	32	14	45	38	13.6	13	10	33	22.2	20.2	2	34.5	26.5	1.3	6.7	7.8	0.15
04	43	40	18	54	47	20	19	15.5	41	25.4	23.4	2	40.2	30.8	1.3	7	9.1	0.15
05	54	50	28	65	58	27.2	26	22	51	28.1	26.1	2	43.3	34.3	1.5	8.2	8.8	0.2

* Size 02 is a rounded flange.
* The rotor of size 02 has no keyway. Lock it in place by press-fitting it onto the shaft or the like.

How to Place an Order

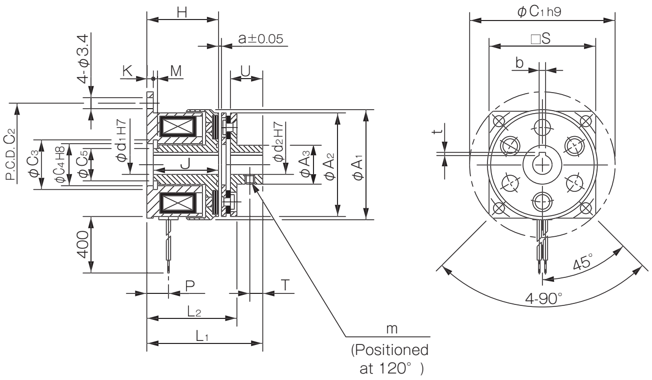
102-03-15 24V R6DIN A6

Size
Rotor bore diameter (dimensional symbol d1)
Armature bore diameter (dimensional symbol d2)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

*Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

Dimensions (102-□-11)

(For butt shafts)



CAD

Unit [mm]

Size	Shaft bore dimensions					
	d₁ H7	d₂ H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
02	5	5	—	—		
03	6	6	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
04	8	8	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
05	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions										Axial direction dimensions									
	A_1	A_2	A_3	C_1	C_2	C_3	C_4	C_5	S	m	H	J	K	L_1	L_2	M	P	U	T	a
02	31	28	9.5	39	33.5	11.4	11	8	—	M3	18	16.5	1.5	27.5	22.5	1.1	5	7	2.5	0.1
03	34	32	12	45	38	13.6	13	10	33	2-M3	22.2	20.2	2	34.5	26.5	1.3	6.7	10	4	0.15
04	43	40	17	54	47	20	19	15.5	41	2-M3	25.4	23.4	2	40.2	30.8	1.3	7	12	5	0.15
05	54	50	24	65	58	27.2	26	22	51	2-M4	28.1	26.1	2	43.3	34.3	1.5	8.2	12	5	0.2

* Size 02 is a rounded flange.
* The rotor of size 02 has no keyway. Lock it in place by press-fitting it onto the shaft or the like.

How to Place an Order

102-03-11 24V R6DIN A6DIN

Size
Rotor bore diameter (dimensional symbol d1)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

*Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

102-□-3□ Types Electromagnetic Micro Clutches - Bearing-mounted Type

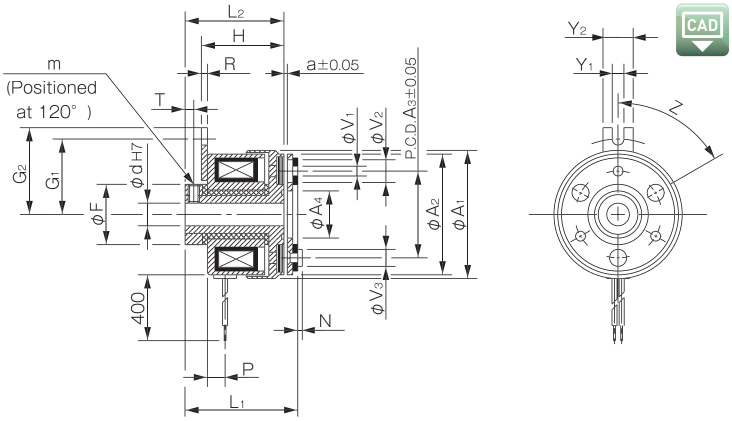
Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J		Allowable engaging energy $E_{a\ell}$ [J]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque rise time t_p [s]	Torque extinction time t_d [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			Armature [kg·m²]	Rotor [kg·m²]						
102-02-33	02	0.4	DC24	6	0.25	96	B	500	6.75×10^{-7}	2.75×10^{-6}	1500	2×10^6	0.009	0.019	0.017	0.076
102-02-35									1.00×10^{-6}							0.082
102-02-31									1.00×10^{-6}							0.080
102-03-33	03	0.6	DC24	6	0.25	96	B	500	1.30×10^{-6}	4.08×10^{-6}	2300	3×10^6	0.009	0.022	0.020	0.101
102-03-35									1.95×10^{-6}							0.110
102-03-31									1.95×10^{-6}							0.108
102-04-33	04	1.2	DC24	8	0.33	72	B	500	4.38×10^{-6}	1.44×10^{-5}	4500	6×10^6	0.011	0.028	0.030	0.183
102-04-35									6.15×10^{-6}							0.200
102-04-31									6.15×10^{-6}							0.196
102-05-33	05	2.4	DC24	10	0.42	58	B	500	9.08×10^{-6}	2.90×10^{-5}	9000	9×10^6	0.012	0.031	0.040	0.321
102-05-35									1.38×10^{-5}							0.346
102-05-31									1.38×10^{-5}							0.336

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.
* The moment of inertia of a rotating body and mass are measured for the maximum bore diameter.
* Keep supply voltage fluctuation to within 10% of coil voltage.

Dimensions (102-□-33)

(For direct mounting)



Unit [mm]

Size	Shaft bore dimensions
	d H7
02	5
03	6
04	8 10
05	10 15

Unit [mm]

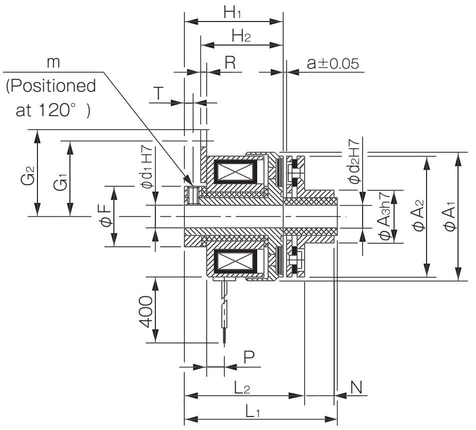
Size	Radial direction dimensions													Axial direction dimensions							
	A_1	A_2	A_3	A_4	F	V_1	V_2	V_3	G_1	G_2	Y_1	Y_2	Z	m	H	R	L_1	L_2	P	N	T	a
02	31	28	19.5	10.5	14	2-2.1	2-5.3	2-4	16.8	20	3.1	8	4-90°	2-M3	19.5	1.6	25.9	23.5	5	0.8	2.5	0.1
03	34	32	23	12.5	16	3-2.6	3-6	3-4.5	20	23	3.1	8	6-60°	2-M3	21.9	1.6	28.5	26.2	4.7	1.2	2.3	0.15
04	43	40	30	18.5	22	3-3.1	3-6	3-5	23	26	3.1	8	6-60°	2-M4	25.1	1.6	33.2	30.4	5	1.5	2.8	0.15
05	54	50	38	25.5	30	3-3.1	3-6.5	3-5.5	28	31	3.1	8	6-60°	2-M5	27.9	1.6	37.3	34.1	6	1.5	3.3	0.2

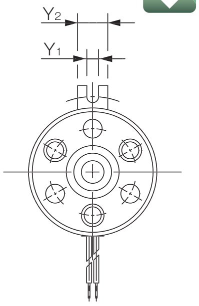
How to Place an Order

102-03-33 24V 6
Size
Rotor bore diameter (dimensional symbol d)

Dimensions (102-□-35)

(For through-shafts)





Unit [mm]

Size	Shaft bore dimensions	
	d_1 H7	d_2 H7
02	5	5
03	6	6
04	8	8
	10	10
05	10	10
	15	15

Unit [mm]

Size	Radial direction dimensions									Axial direction dimensions								
	A_1	A_2	A_3	F	G_1	G_2	Y_1	Y_2	m	H_1	H_2	R	L_1	L_2	P	N	T	a
02	31	28	13	14	16.8	20	3.1	8	2-M3	23.5	19.5	1.6	33	27.9	5	4.8	2.5	0.1
03	34	32	14	16	20	23	3.1	8	2-M3	26.2	21.9	1.6	38.5	30.5	4.7	7.8	2.3	0.15
04	43	40	18	22	23	26	3.1	8	2-M4	30.4	25.1	1.6	45.2	35.8	5	9.1	2.8	0.15
05	54	50	28	30	28	31	3.1	8	2-M5	34.1	27.9	1.6	49.3	40.3	6	8.8	3.3	0.2

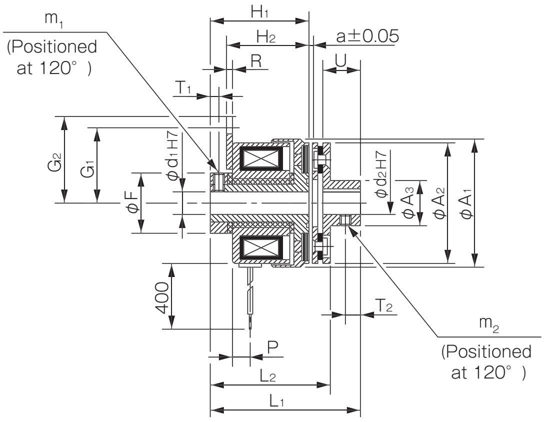
How to Place an Order

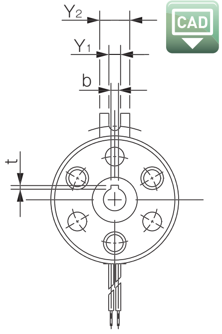
102-03-35 24V R6 A6

Size
Armature bore diameter (dimensional symbol d2)
Rotor bore diameter (dimensional symbol d1)

Dimensions (102-□-31)

(For butt shafts)





Unit [mm]

Size	Shaft bore dimensions					
	d_1 H7	d_2 H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
02	5	5	—	—		
03	6	6	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
04	8	8	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
05	10	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions										Axial direction dimensions									
	A_1	A_2	A_3	F	G_1	G_2	Y_1	Y_2	m_1	m_2	H_1	H_2	R	L_1	L_2	P	U	T_1	T_2	a
02	31	28	9.5	14	16.8	20	3.1	8	2-M3	M3	23.5	19.5	1.6	33	27.9	5	7	2.5	2.5	0.1
03	34	32	12	16	20	23	3.1	8	2-M3	2-M3	26.2	21.9	1.6	38.5	30.5	4.7	10	2.3	4	0.15
04	43	40	17	22	23	26	3.1	8	2-M4	2-M3	30.4	25.1	1.6	45.2	35.8	5	12	2.8	5	0.15
05	54	50	24	30	28	31	3.1	8	2-M5	2-M4	34.1	27.9	1.6	49.3	40.3	6	12	3.3	5	0.2

How to Place an Order

102-03-31 24V R6 A6DIN

Size
Rotor bore diameter (dimensional symbol d1)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)

*Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

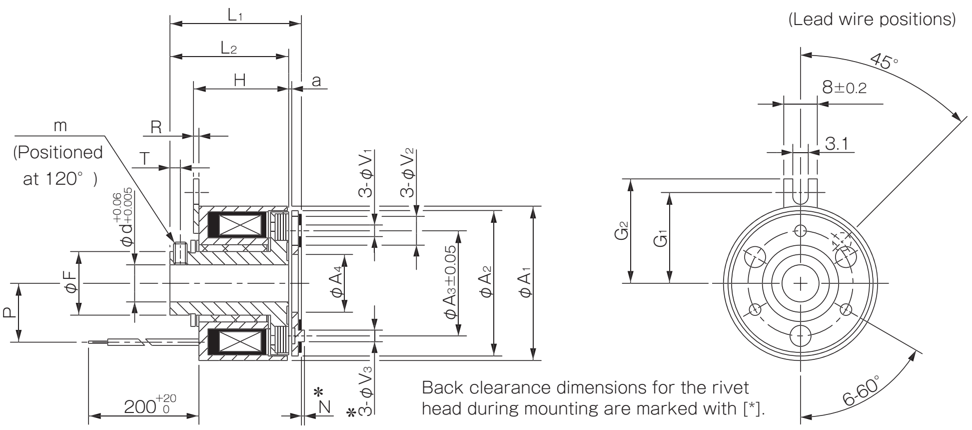
CYT Models Electromagnetic Micro Clutches - Bearing-mounted Type

Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia		Allowable engaging energy $E_{ea\ell}$ [J]	Total work E_T [J]	Armature pull-in time t_a [s]	Torque rise time t_p [s]	Torque extinction time t_d [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			Armature [kg·m^2]	Rotor [kg·m^2]						
CYT-025-33B	025	0.4	DC24	4.5	0.188	128	B	3600	1.00 × 10^{-6}	1.43 × 10^{-6}	800	1.0 × 10^6	0.014	0.028	0.030	0.07
CYT-03-33B	03	0.5	DC24	5.5	0.23	105	B	3600	1.30 × 10^{-6}	1.85 × 10^{-6}	900	1.5 × 10^6	0.015	0.030	0.040	0.13
CYT-03-33M								500		1.90 × 10^{-6}						0.11
CYT-04-33B	04	1.0	DC24	5.9	0.25	98	B	3600	5.15 × 10^{-6}	1.00 × 10^{-5}	1900	2.0 × 10^6	0.030	0.040	0.040	0.26
CYT-04-33M								500		1.05 × 10^{-5}						0.23

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.
* The rotating part moment of inertia and mass are measured for the maximum bore diameter.
* Keep supply voltage fluctuation to within 10% of coil voltage. Also, be careful that energization does not exceed 50%.

Dimensions (CYT-□-33M)



Back clearance dimensions for the rivet head during mounting are marked with [*].

Unit [mm]

Size	Radial direction dimensions											Axial direction dimensions							
	d	A_1	A_2	A_3	A_4	F	V_1	V_2	V_3	G_1	G_2	m	H	R	L_1	L_2	P	N	T	a
03	6 8	34	32	23	12.5	14	3-2.6	3-5.5	3-6	20	23	M3	21	1.2	28.6	26.2	13	3	2.3	0.2 ± 0.05
04	8 10	45	42	30	18.5	18	3-3.1	3-6	3-6	25	27.5	M4	25.3	1.2	35.1	32.4	17.5	3.5	3	0.2 $^{+0.05}_{-0.1}$

* Dimensional symbols N and V3 indicate the clearance dimensions for the rivet head during mounting.

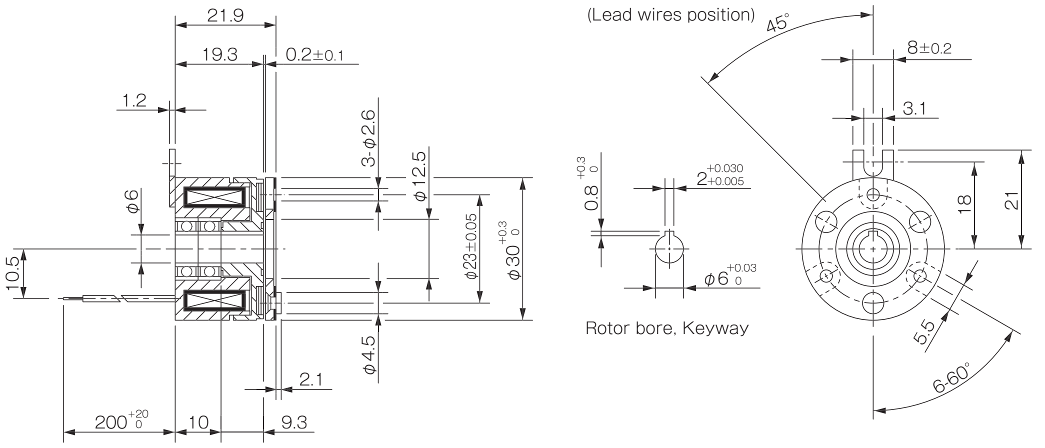
How to Place an Order

CYT-03-33M 24V 6

Size

Rotor bore diameter (dimensional symbol d)

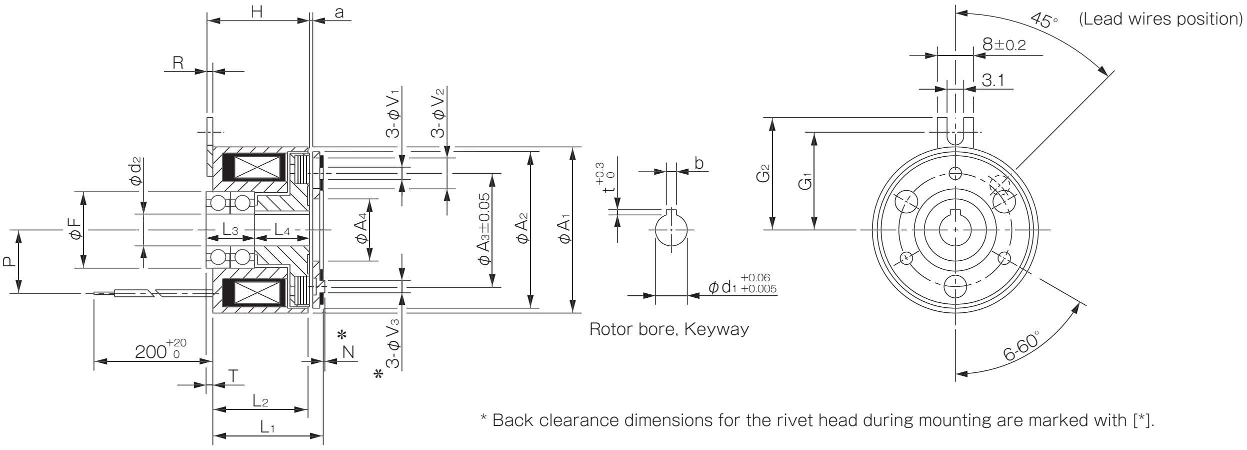
Dimensions (CYT-025-33B)



How to Place an Order

CYT-025-33B 24V 6

Dimensions (CYT-□-33B)



* Back clearance dimensions for the rivet head during mounting are marked with [*].

Unit [mm]

Size	Nominal diameter	Radial direction dimensions										Axial direction dimensions										Shaft bore dimensions			
		A_1	A_2	A_3	A_4	F	V_1	V_2	V_3	G_1	G_2	H	R	L_1	L_2	L_3	L_4	P	N	T	a	d_2	d_1	b	t
03	6	34	32	23	12.5	15	3-2.6	3-5.5	3-6	20	23	21	1.2	22.2	19.8	10	11.3	13	3	1.5	0.2 ± 0.05	6	6	$2\ ^{+0.030}_{+0.005}$	$0.8\ ^{+0.3}_{0}$
	8	34	32	23	12.5	16	3-2.6	3-5.5	3-6	20	23	21	1.2	22.2	19.8	10	11.3	13	3	1.5	0.2 ± 0.05	8	8	$2\ ^{+0.030}_{+0.005}$	$0.8\ ^{+0.3}_{0}$
04	8	45	42	30	18.5	19	3-3.1	3-6	3-6	25	28	25.3	1.2	26.8	24.1	12	13	17.5	3.5	0.9	$0.2\ ^{+0.05}_{-0.1}$	8	8	$2\ ^{+0.030}_{+0.005}$	$0.8\ ^{+0.3}_{0}$
	10	45	42	30	18.5	19	3-3.1	3-6	3-6	25	28	25.3	1.2	26.8	24.1	14	11	17.5	3.5	0.9	$0.2\ ^{+0.05}_{-0.1}$	10	10	$3\ ^{+0.025}_{0}$	$1.2\ ^{+0.3}_{0}$

* Dimensional symbols N and V3 indicate the clearance dimensions for the rivet head during mounting.

How to Place an Order

CYT-03-33B 24V 6

Size

Nominal diameter

112 Models Electromagnetic Micro Brakes

Specifications

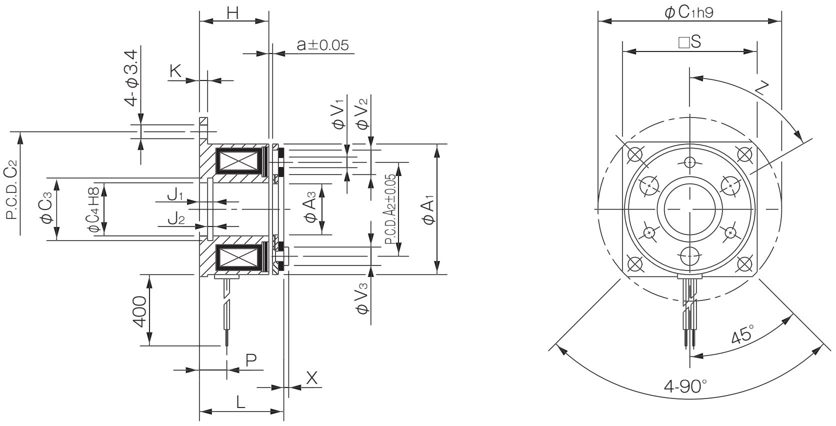
Model	Size	Dynamic friction torque Td [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Armature moment of inertia J [kg·m²]	Allowable engaging energy Eaℓ [J]	Total work performed until Readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque build-up time tp [s]	Torque decaying time td [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
112-02-13	02	0.4	DC24	6	0.25	96	B	10000	6.75×10^{-7}	1500	2×10^6	0.004	0.010	0.010	0.053
112-02-12									1.00×10^{-6}						0.057
112-02-11									1.00×10^{-6}						0.057
112-03-13	03	0.6	DC24	6	0.25	96	B	10000	1.30×10^{-6}	2300	3×10^6	0.005	0.012	0.008	0.072
112-03-12									1.95×10^{-6}						0.079
112-03-11									1.95×10^{-6}						0.079
112-04-13	04	1.2	DC24	8	0.33	72	B	10000	4.38×10^{-6}	4500	6×10^6	0.007	0.016	0.010	0.118
112-04-12									6.15×10^{-6}						0.131
112-04-11									6.15×10^{-6}						0.131
112-05-13	05	2.4	DC24	10	0.42	58	B	10000	9.08×10^{-6}	9000	9×10^6	0.010	0.023	0.012	0.200
112-05-12									1.38×10^{-5}						0.215
112-05-11									1.38×10^{-5}						0.215

* The dynamic friction torque, Td, is measured at a relative speed of 100 min⁻¹.

* The rotating part moment of inertia and mass are measured for the maximum bore diameter.

* Keep supply voltage fluctuation to within 10% of coil voltage.

Dimensions (112-□-13)



Unit [mm]

Size	Radial direction dimensions												Axial direction dimensions							
	A_1	A_2	A_3	C_1	C_2	C_3	C_4	S	V_1	V_2	V_3	Z	H	K	J_1	J_2	L	P	X	a
02	28	19.5	10.5	39	33.5	11.4	11	—	2-2.1	2-5.3	2-4	4-90°	13.7	1.5	2.6	1.3	16.1	5	0.8	0.1
03	32	23	12.5	45	38	13.6	13	33	3-2.6	3-6	3-4.5	6-60°	17	2	3.3	1.3	19.3	6.7	1.2	0.15
04	40	30	18.5	54	47	20	19	41	3-3.1	3-6	3-5	6-60°	20	2	3.3	1.3	22.8	7	1.6	0.15
05	50	38	25.5	65	58	27.2	26	51	3-3.1	3-6.5	3-5.5	6-60°	22	2	3.5	1.5	25.2	8	1.6	0.2

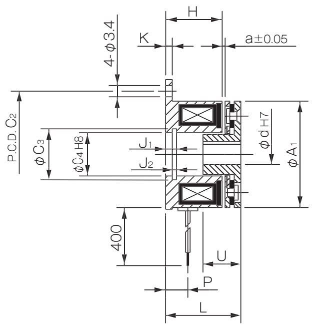
* Size 02 is a rounded flange.

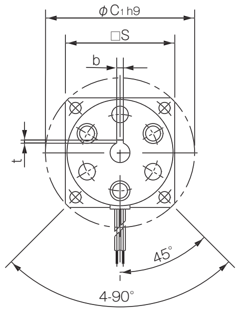
How to Place an Order

112-03-13 24V

Size

Dimensions (112-□-12)





Unit [mm]

Size	Shaft bore dimensions				
	d	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
	H7	b P9	t	b E9	t
02	5	—	—		
03	6	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
04	8	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
05	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions						Axial direction dimensions							
	A_1	C_1	C_2	C_3	C_4	S	H	K	J_1	J_2	L	P	U	a
02	28	39	33.5	11.4	11	—	13.7	1.5	2.6	1.3	18.1	5	7	0.1
03	32	45	38	13.6	13	33	17	2	3.3	1.3	21.3	6.7	10	0.15
04	40	54	47	20	19	41	20	2	3.3	1.3	25.5	7	12	0.15
05	50	65	58	27.2	26	51	22	2	3.5	1.5	28.2	8	12	0.2

* Size 02 is a rounded flange.
* The armature hub of size 02 has no keyway. Lock it in place by press-fitting it onto the shaft or the like.

How to Place an Order

112-03-12 24V 6DIN

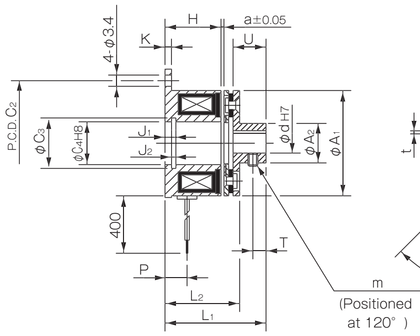
Size

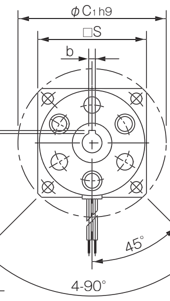
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Armature bore diameter (dimensional symbol d)

* Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

Dimensions (112-□-11)





Unit [mm]

Size	Shaft bore dimensions				
	d	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
	H7	b P9	t	b E9	t
02	5	—	—		
03	6	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
04	8	$2^{-0.006}_{-0.031}$	$0.8^{+0.3}_{0}$		
	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
05	10	$3^{-0.006}_{-0.031}$	$1.2^{+0.3}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions								Axial direction dimensions									
	A_1	A_2	C_1	C_2	C_3	C_4	S	m	H	K	J_1	J_2	L_1	L_2	P	U	T	a
02	28	9.5	39	33.5	11.4	11	—	M3	13.7	1.5	2.6	1.3	23.1	18.1	5	7	2.5	0.1
03	32	12	45	38	13.6	13	33	2-M3	17	2	3.3	1.3	29.3	21.3	6.7	10	4	0.15
04	40	17	54	47	20	19	41	2-M3	20	2	3.3	1.3	34.8	25.5	7	12	5	0.15
05	50	24	65	58	27.2	26	51	2-M4	22	2	3.5	1.5	37.2	28.2	8	12	5	0.2

* Size 02 is a rounded flange.

How to Place an Order

112-03-11 24V 6DIN

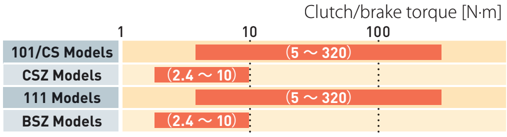
Size

Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Armature bore diameter (dimensional symbol d)

* Models for which there are no keyway standards (models marked by [-]) on the Shaft Bore Dimensions table need not be marked with a keyway standards designation. Products with standards marked by diagonal lines are not set as standard products.

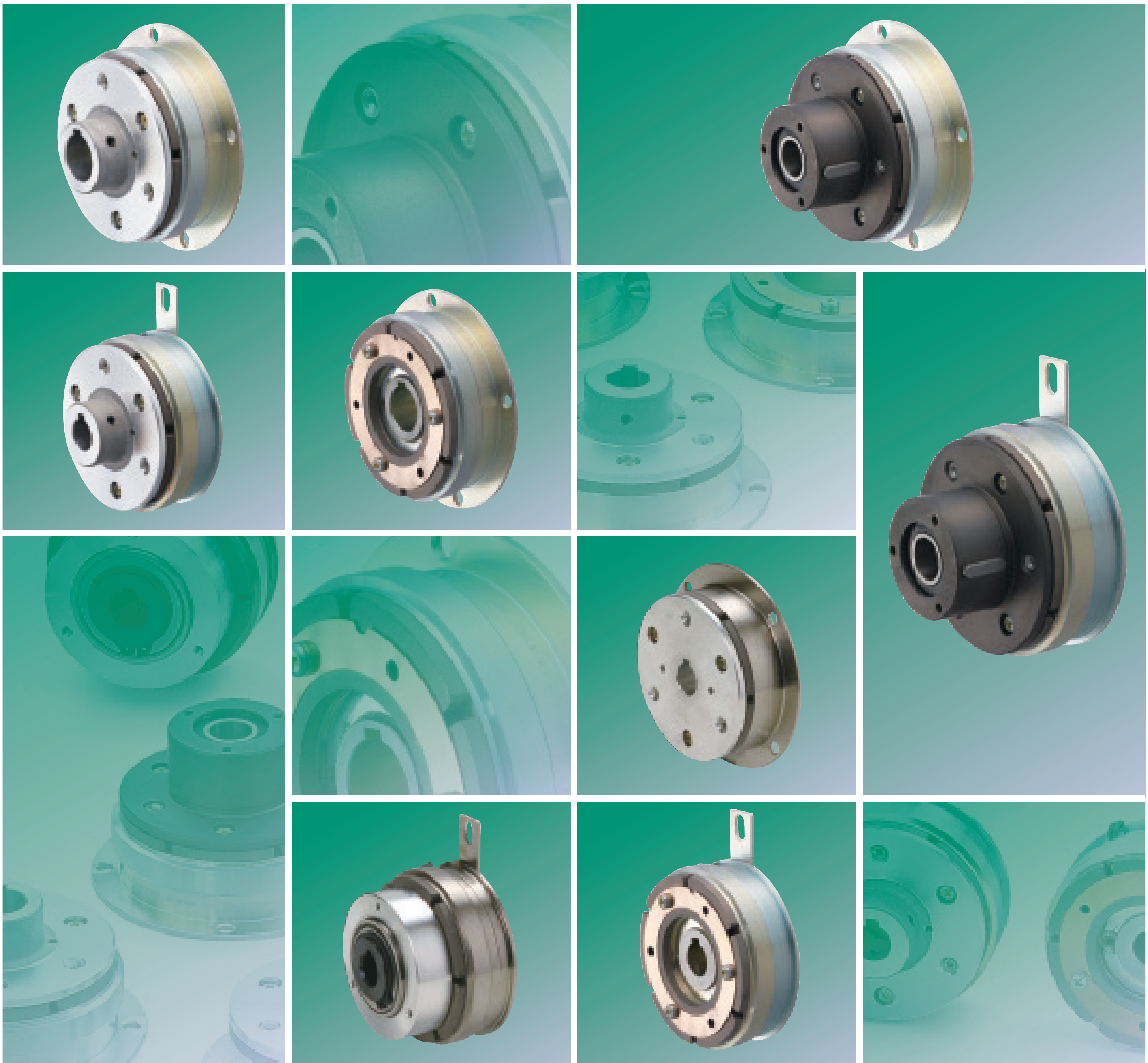
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES



Application	Printing machinery, bookbinding machinery, food machinery, wrapping machinery, textiles machinery

Clutches and Brakes that Accurately Control a Variety of General Industrial Machinery

Clutches accurately connect and release power by being located between the driver and the load. Brakes are used to slow or stop load inertia and machinery and to hold things in stationary positions. Using these basic operations and combining clutches and brakes enable a variety of applications such as stepped speed-changing mechanisms, switching between forward and reverse operation, positioning/indexing, and inching. Part of their appeal is the simplicity of control and ease of maintenance.



Available Models

Series	Applications		Lineup
CLUTCHES & BRAKES	Clutches	Standard type	101/CS
		One-touch mounted type	CSZ
	Brakes	Standard type	111
		One-touch mounted type	BSZ

For details on selection, see P.308 to 315.

Clutches

101-□-1□
Mounting — Size — Shaft Coupling System (Armature)

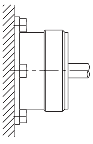
CS-□-3□
Mounting — Size — Shaft Coupling System (Armature)

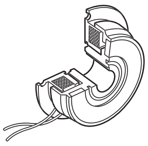
Mounting

101

Wall-mounted type

Uses a flange-mounted stator. Designed to be short in the axial direction, requiring less installation space.

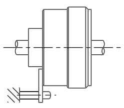

Directly mounted to the wall

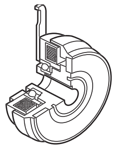

Flange-mounted type

CS

Shaft-mounted type

Uses a bearing-mounted stator. Designed to be relatively easy to mount, reducing the processing and work required for mounting.


Mounted onto the shaft

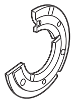

Bearing-mounted type

Shaft Coupling System (Armatures)

101-□-□3, CS-□-□3

Butt and parallel shaft type (Armature type-3)

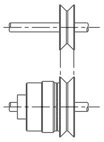
These incorporate non-armature parts provided by the customer such as V pulleys, enabling use in designs that use either butt shafts or through-shafts.

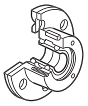

Armature type-3

101-□-□5, CS-□-□5

Directly coupled type wound around the parallel axis (armature type-5)

Uses an armature assembly designed for use with through-shafts. Ensures that mounting is relatively easy to complete as well as extremely efficient in its approach.

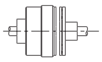

Directly coupled by being wound around the parallel shaft

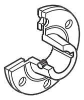

Armature type-5

101-□-□1, CS-□-□1

Butt type (Armature type-1)

Uses an armature assembly designed for use with butt shafts. May be difficult to mount due to the need for centering and other adjustments, may require the use of a fitting flange, or may require use in combination with flexible couplings.


Coupled directly to the butt shaft

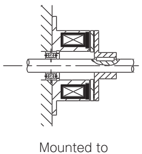

Armature type-1

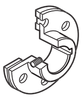
Brake

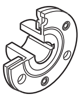
111-□-1□
Size — Shaft Coupling System (Armature)

Shaft-mounted type

These use axial braking in most cases, the effectiveness of which depends on how efficiently parts are mounted.

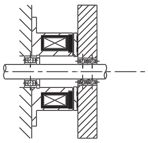

Mounted to the shaft

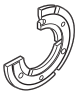

Armature type-1


Armature type-2

Rotor-mounted type

Uses an armature assembly mounted directly to an inertial body not fastened to the shaft that continues to move even after the shaft has stopped.


Mounted to the rotor


Armature type-3

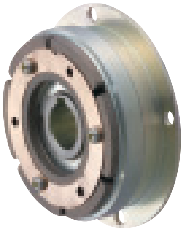
One-touch mounted type

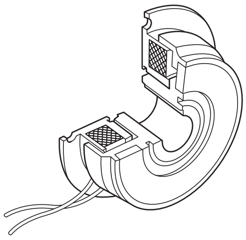
CSZ, BSZ

Designed with the same basic construction as that of the standard type. Comes equipped with a stator armature, eliminating the need for time-consuming gap adjustments. Easy to assemble, guaranteeing dramatic reductions in assembly times.

Product Lineup

101 Electromagnetic-actuated Clutches - Flange-mounted Type

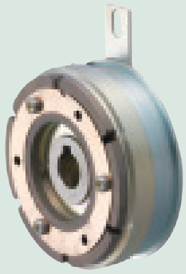

RoHS-compliant

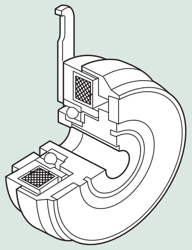

Flange-mounted type

Stator and rotor are combined and directly mounted on stationary parts, such as frames, and fixed in place. These are short in the axial direction and can make effective use of space near windows. Select the armature according to the coupling type used (through-shaft, butt shaft, etc.).

Clutch torque	[N·m]	5 ～ 320
Operating temperature	[℃]	－10 ～＋40
Backlash		Zero

CS Electromagnetic-actuated Clutches - Bearing-mounted Type

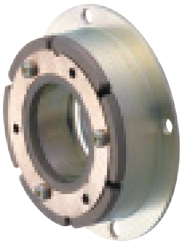

RoHS-compliant

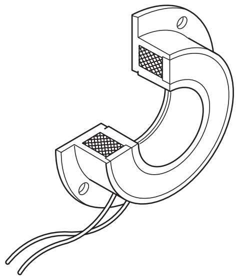

Bearing-mounted type

These integrate the stator and rotor, which are held to the stationary parts of the machine by a drive pin arm; the rotor is locked to the rotation shaft by a key. They are designed to be relatively easy to mount, reducing the processing work required for mounting.

Clutch torque	[N·m]	5 ～ 320
Operating temperature	[℃]	－10 ～＋40
Backlash		Zero

111 Electromagnetic-actuated Brakes

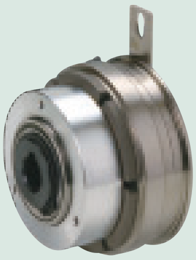

RoHS-compliant



Brakes are used to brake and hold rotating bodies. The flange of the stator is locked securely to a strong stationary part. Select an armature that factors in the mounting space available.

Brake torque	[N·m]	5 ～ 320
Operating temperature	[℃]	－10 ～＋40
Backlash		Zero

CSZ/BSZ Electromagnetic-actuated Clutches & Brakes - One-touch-mounted Type

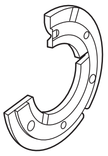

CSZ
RoHS-compliant


BSZ
RoHS-compliant

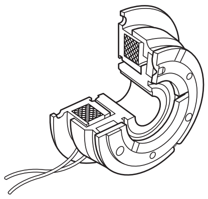
These models adjust the gap to the frictional surface that clutches and brakes require to operate and come pre-assembled. Clutches are simply placed on the shaft and brakes mounted on the flange surface. They do not require gap adjustment or adjustment of concentricity/parallel misalignment, greatly reducing installation work.

Clutch/brake torque	[N·m]	2.4 ～ 10
Operating temperature	[℃]	－10 ～＋40
Backlash		Zero

Types for through-shaft or butt shaft

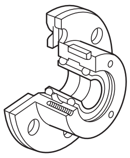


Armature type-3

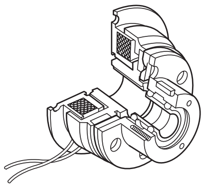


101-☐-13G

Through-shaft (coupled by winding around parallel shaft) type

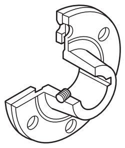


Armature type-5

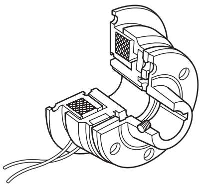


101-☐-15G

Butt shaft type

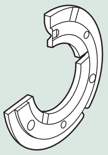


Armature type-1

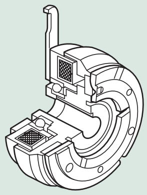


101-☐-11G

Types for through-shaft or butt shaft

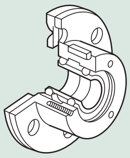


Armature type-3

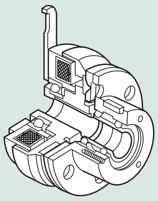


CS-☐-33G

Through-shaft (coupled by winding around parallel shaft) type

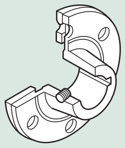


Armature type-5

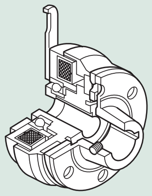


CS-☐-35G

Butt shaft type

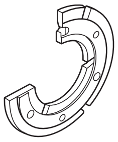


Armature type-1

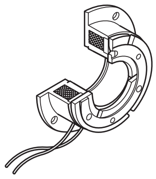


CS-☐-31G

Types with many applications

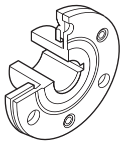


Armature type-3

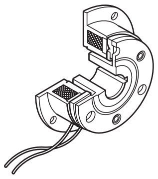


111-☐-13G

Slim, space-saving type

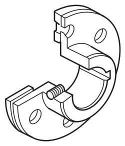


Armature type-2

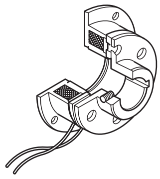


111-☐-12G

Easy-to-use standard-shape type

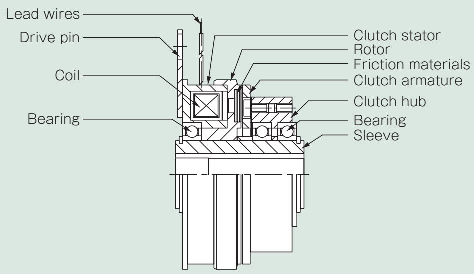


Armature type-1

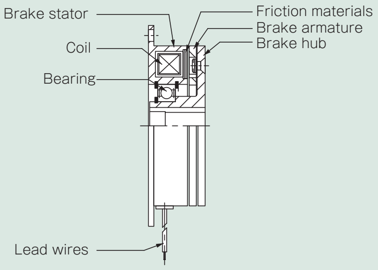


111-☐-11G

CSZ



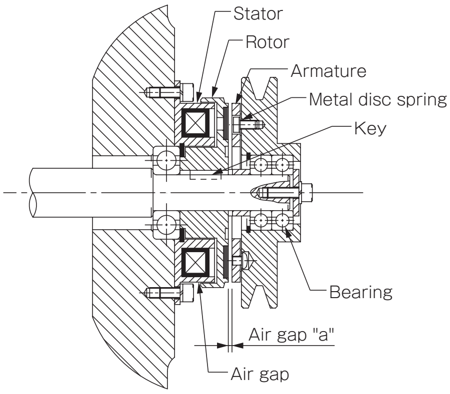
BSZ



Mounting Example

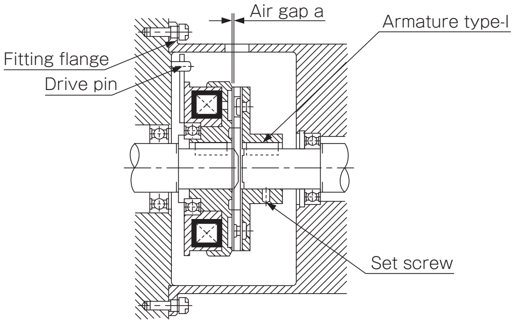
Flange-mounting example with 101

The stator is directly mounted on a stationary part, such as a frame, by a mounting flange, and fixed in place. The rotor is locked to the rotation shaft using a key. The stator and rotor are combined via a narrow air gap that serves as part of the magnetic circuit to form a magnetic pole.



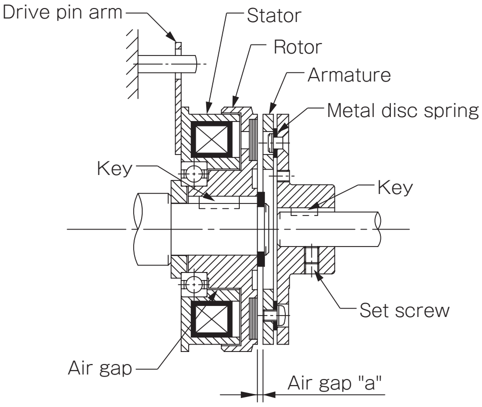
Butt shaft mounting example with CS

In designs that use butt shafts, the two shafts can be reliably centered using fitting flanges, as shown in the figure.



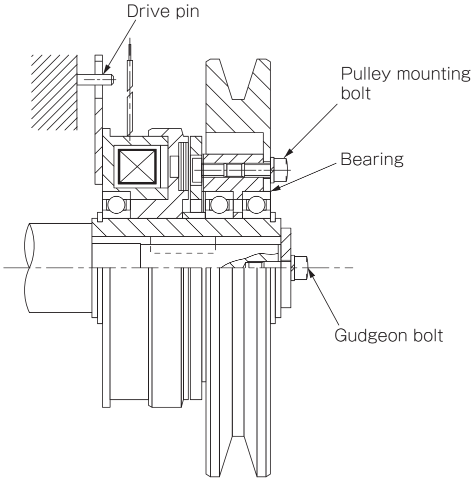
Bearing-mounting example with CS

The stator is integrated with the rotor via a bearing and held to the stationary parts of the machine by a drive pin arm. The rotor is locked to the rotation shaft using a set screw. The stator and rotor form a magnetic pole via the bearing.



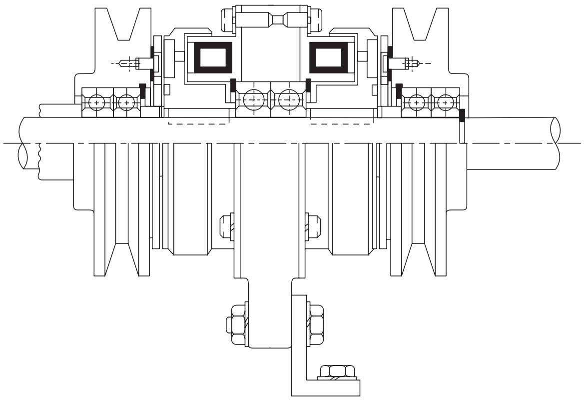
Mounting example with CSZ

Simply insert the shaft in the sleeve and fasten a CSZ on the shaft end and mounting is complete.



Example of combining clutches

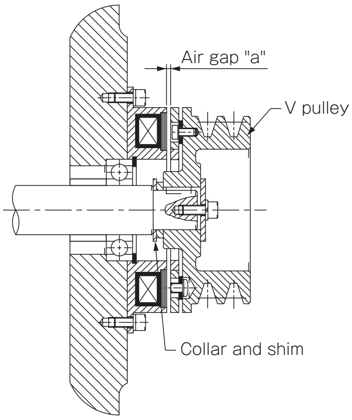
In this example, two clutches are assembled on a through-shaft. This is very effective when controls such as two-step speed changing and forward/reverse operation are needed and space is limited.



Mounting Example

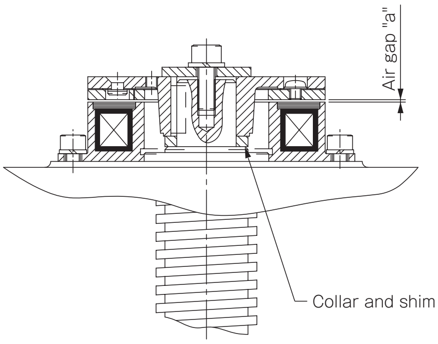
Armature type-3 mounting example with 111

When armature type-3 is directly mounted on the end face of a V pulley, no armature hub is needed, making for a very efficient design. These are optimal when space is limited or when a shaft overhangs from a wall and the overhang load must be kept extremely low.



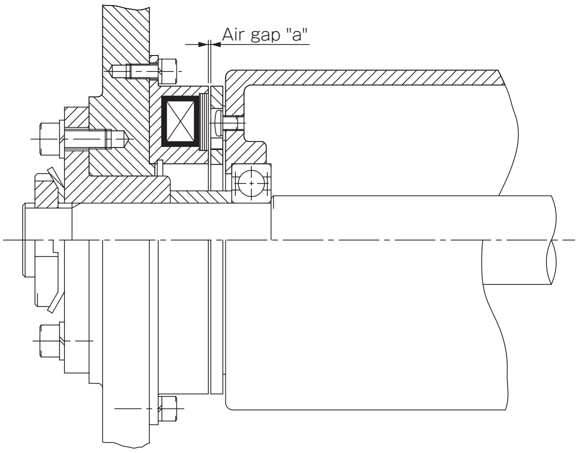
Armature type-2 mounting example on vertical shaft with 111

Armature type-2 is a special armature that puts the boss part of the armature hub into the space within the stator. That makes it compact. It is short in the axial direction even when a pulley or the like is installed on the tip of the brake. Since running torque is zero, it does not take up space even when mounted on a vertical shaft, and is also easy to install.
Air gap "a" can be set easily using collars and shims.
Corrections are easily accomplished by adding or removing shims.



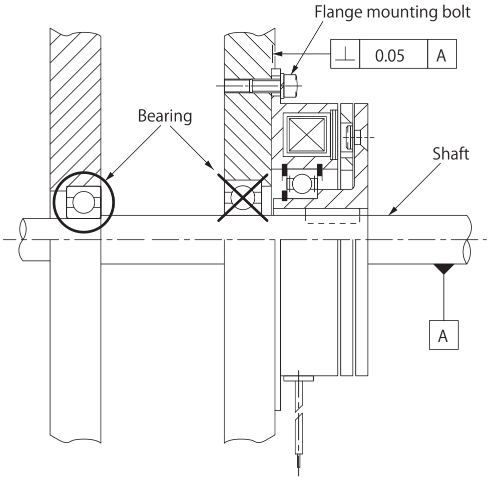
Armature type-3 mounting example with 111

If a rotating body floating above a shaft by means of a bearing (an idler pulley, guide roller, or the like) has an armature type-3 mounted on it directly, it can be assembled easily without taking up a lot of space.
Air gap "a" can be set easily using collars and shims.
Corrections are easily accomplished by adding or removing shims.



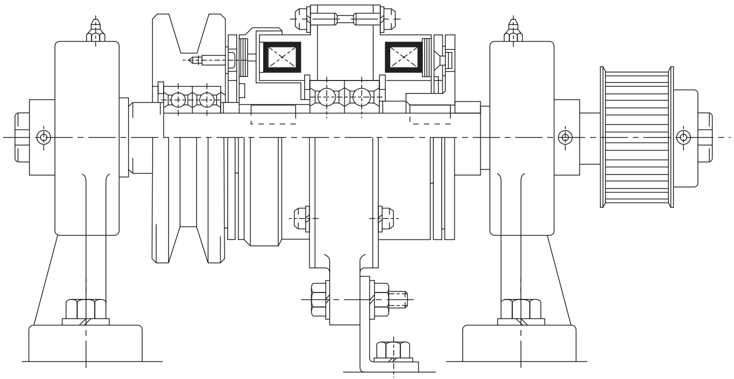
Mounting example with BSZ

Simply insert onto the shaft to be braked and lock the BSZ on the wall surface and mounting is complete. Be careful when designing that the mounting shaft does not cantilever and end up a three-point mounting.



Example of combining clutches and brakes

In this example, a clutch and brake are assembled on a through-shaft. This is effective when mounting space is limited or when there is no wall on which to mount the stator.



101 Models Electromagnetic Clutches - Flange-mounted Type

Specifications

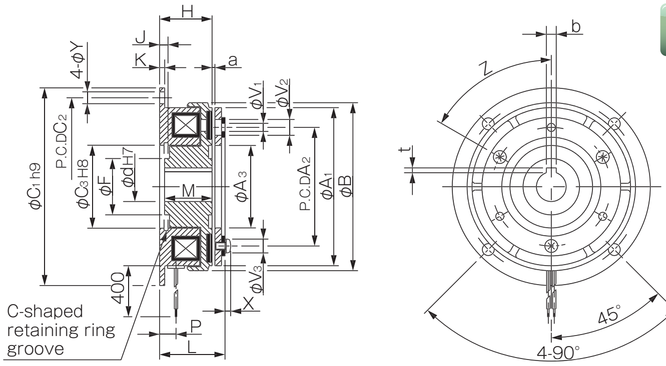
Model	Size	Dynamic friction torque Td [N·m]	Static friction torque Ts [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J		Total work performed until readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque build-up time tp [s]	Torque decaying time td [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			Rotor [kg·m²]	Armature [kg·m²]					
101-06-13G	06	5	5.5	DC24	11	0.46	52	B	8000	7.35×10^{-5}	4.23×10^{-5}	36×10^{6}	0.020	0.041	0.020	0.46
101-06-15G											1.05×10^{-4}					0.66
101-06-11G											6.03×10^{-5}					0.5
101-08-13G	08	10	11	DC24	15	0.63	38	B	6000	2.24×10^{-4}	1.18×10^{-4}	60×10^{6}	0.023	0.051	0.030	0.83
101-08-15G											3.00×10^{-4}					1.19
101-08-11G											1.71×10^{-4}					0.91
101-10-13G	10	20	22	DC24	20	0.83	29	B	5000	6.78×10^{-4}	4.78×10^{-4}	130×10^{6}	0.025	0.063	0.050	1.5
101-10-15G											9.45×10^{-4}					2.11
101-10-11G											6.63×10^{-4}					1.66
101-12-13G	12	40	45	DC24	25	1.09	23	B	4000	2.14×10^{-3}	1.31×10^{-3}	250×10^{6}	0.040	0.115	0.065	2.76
101-12-15G											2.75×10^{-3}					3.8
101-12-11G											1.81×10^{-3}					3.05
101-16-13G	16	80	90	DC24	35	1.46	16	B	3000	6.30×10^{-3}	4.80×10^{-3}	470×10^{6}	0.050	0.160	0.085	5.1
101-16-15G											9.05×10^{-3}					6.9
101-16-11G											6.35×10^{-3}					5.4
101-20-13G	20	160	175	DC24	45	1.88	13	B	2500	1.93×10^{-2}	1.37×10^{-2}	10×10^{8}	0.090	0.250	0.130	9.3
101-20-15G											2.65×10^{-2}					13
101-20-11G											1.90×10^{-2}					10.5
101-25-13G	25	320	350	DC24	60	2.5	9.6	B	2000	4.48×10^{-2}	3.58×10^{-2}	20×10^{8}	0.115	0.335	0.210	17
101-25-15G											7.45×10^{-2}					23.6
101-25-11G											4.83×10^{-2}					18.7

* The dynamic friction torque, Td, is measured at a relative speed of 100 min^{-1}.

* The rotating part moment of inertia and mass are measured for the maximum bore diameter.

Dimensions (101-□-13G)

(For direct mounting)



Unit [mm]

Size	Shaft bore dimensions				
	d	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
	H7	b P9	t	b E9	t
06	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
08	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
12	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
20	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
25	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
	60	$18^{-0.018}_{-0.061}$	$4^{+0.5}_{0}$	$15^{+0.075}_{+0.032}$	$5^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions													Axial direction dimensions							
	A_1	A_2	A_3	B	C_1	C_2	C_3	F	V_1	V_2	V_3	Y	Z	H	J	K	L	M	P	X	a
06	63	46	34.5	67.5	80	72	35	23	3-3.1	3-6.3	3-5.5	5	6-60°	24	3.5	2.1	28	22	7.3	2.5	0.2 ± 0.05
08	80	60	41.5	85	100	90	42	28.5	3-4.1	3-8	3-7	6	6-60°	26.5	4.3	2.6	31	24	8.3	2.85	0.2 ± 0.05
10	100	76	51.5	106	125	112	52	40	3-5.1	3-10.5	3-9	7	6-60°	30	5	3.1	36	27	9	3.3	0.2 ± 0.05
12	125	95	61.5	133	150	137	62	45	3-6.1	3-12	3-11	7	6-60°	33.5	5.5	3.6	40.5	30	9.3	3.3	$0.3^{+0.05}_{-0.1}$
16	160	120	79.5	169	190	175	80	62	3-8.1	3-15	3-14	9.5	6-60°	37.5	6	4.1	46.5	34	11.7	3.5	$0.3^{+0.05}_{-0.1}$
20	200	158	99.5	212.5	230	215	100	77	3-10.2	3-18	3-17	9.5	6-60°	44	7	5.1	55.5	40	13.4	4.9	$0.5^{0}_{-0.2}$
25	250	210	124.5	264	290	270	125	100	4-12.2	4-22	4-20	11.5	8-45°	51	8	6.1	64	47	16	5.5	$0.5^{0}_{-0.2}$

How to Place an Order

101-06-13G 24V 12DIN

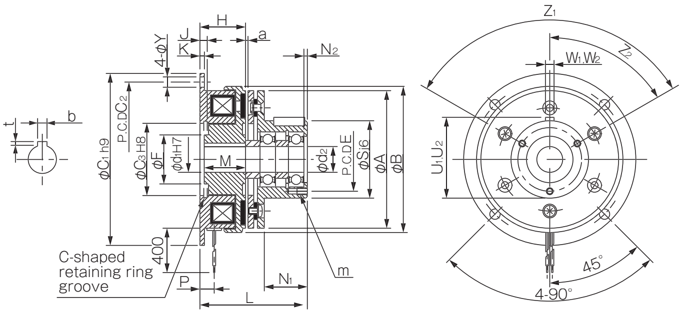
Size

Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Rotor bore diameter (dimensional symbol d)

Dimensions (101-□-15G)

(For through-shafts)



Unit [mm]

Size	Shaft bore dimensions					
	d1 H7	d2	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
06	12	12	$4\,^{-0.012}_{-0.042}$	$1.5\,^{+0.5}_{0}$	$4\,^{+0.050}_{+0.020}$	$1.5\,^{+0.5}_{0}$
08	15	15	$5\,^{-0.012}_{-0.042}$	$2\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
10	20	20	$6\,^{-0.012}_{-0.042}$	$2.5\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
12	25	25	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
16	30	30	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
20	40	40	$12\,^{-0.018}_{-0.061}$	$3\,^{+0.5}_{0}$	$10\,^{+0.061}_{+0.025}$	$3.5\,^{+0.5}_{0}$
25	50	50	$14\,^{-0.018}_{-0.061}$	$3.5\,^{+0.5}_{0}$	$12\,^{+0.075}_{+0.032}$	$3.5\,^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions											Axial direction dimensions													
	A	B	C_1	C_2	C_3	E	F	Y	S	Z_1	Z_2	H	J	K	L	M	N_1	N_2	P	U_1	W_1	U_2	W_2	a	m
06	63	67.5	80	72	35	33	23	5	38	3-120°	60°	24	3.5	2.1	51.5	22	20	2	7.3	39.5	4	39.5	4	0.2 ± 0.05	3-M4 × 0.7, length: 4
08	80	85	100	90	42	37	28.5	6	45	3-120°	60°	26.5	4.3	2.6	60	24	25	2	8.3	47	5	47	5	0.2 ± 0.05	3-M4 × 0.7, length: 6
10	100	106	125	112	52	47	40	7	55	4-90°	45°	30	5	3.1	71	27	30	3	9	57	5	57.5	6	0.2 ± 0.05	4-M4 × 0.7, length: 8
12	125	133	150	137	62	52	45	7	64	4-90°	45°	33.5	5.5	3.6	86.5	30	40	2	9.3	67	7	67	8	$0.3\,^{+0.05}_{-0.1}$	4-M4 × 0.7, length: 8
16	160	169	190	175	80	62	62	9.5	75	6-60°	30°	37.5	6	4.1	103.5	34	50	3	11.7	78	7	78	8	$0.3\,^{+0.05}_{-0.1}$	6-M5 × 0.8, length: 8
20	200	212.5	230	215	100	74.5	77	9.5	90	4-90°	45°	44	7	5.1	124.5	40	60	5	13.4	93.5	10	93	10	$0.5\,^{0}_{-0.2}$	4-M6 × 1, length: 12
25	250	264	290	270	125	101.5	100	11.5	115	8-45°	22.5°	51	8	6.1	145	47	70	6	16	118.5	12	118	12	$0.5\,^{0}_{-0.2}$	8-M6 × 1, length: 12

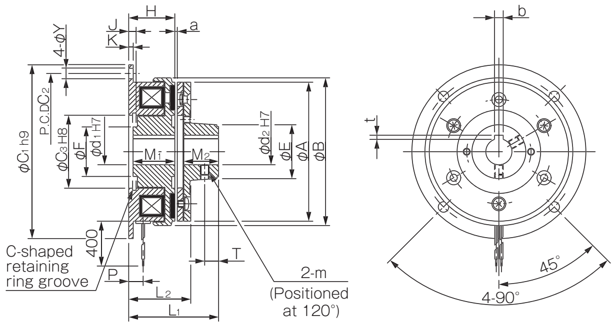
How to Place an Order

101-06-15G 24V R12DIN A12JIS

Size
Rotor bore diameter (dimensional symbol d1)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)
Armature type-5 keyway standards
Dimensional symbol U2, W2: Compliant with the new JIS standards: DIN
Dimensional symbol U1, W1: Compliant with the old JIS standards: JIS

Dimensions (101-□-11G)

(For butt shafts)



Unit [mm]

Size	Shaft bore dimensions					
	d1 H7	d2 H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
06	12	12	$4\,^{-0.012}_{-0.042}$	$1.5\,^{+0.5}_{0}$	$4\,^{+0.050}_{+0.020}$	$1.5\,^{+0.5}_{0}$
	15	15	$5\,^{-0.012}_{-0.042}$	$2\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
08	15	15	$5\,^{-0.012}_{-0.042}$	$2\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
	20	20	$6\,^{-0.012}_{-0.042}$	$2.5\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
10	20	20	$6\,^{-0.012}_{-0.042}$	$2.5\,^{+0.5}_{0}$	$5\,^{+0.050}_{+0.020}$	$2\,^{+0.5}_{0}$
	25	25	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
12	25	25	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
	30	30	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
16	30	30	$8\,^{-0.015}_{-0.051}$	$3\,^{+0.5}_{0}$	$7\,^{+0.061}_{+0.025}$	$3\,^{+0.5}_{0}$
	40	40	$12\,^{-0.018}_{-0.061}$	$3\,^{+0.5}_{0}$	$10\,^{+0.061}_{+0.025}$	$3.5\,^{+0.5}_{0}$
20	40	40	$12\,^{-0.018}_{-0.061}$	$3\,^{+0.5}_{0}$	$10\,^{+0.061}_{+0.025}$	$3.5\,^{+0.5}_{0}$
	50	50	$14\,^{-0.018}_{-0.061}$	$3.5\,^{+0.5}_{0}$	$12\,^{+0.075}_{+0.032}$	$3.5\,^{+0.5}_{0}$
25	50	50	$14\,^{-0.018}_{-0.061}$	$3.5\,^{+0.5}_{0}$	$12\,^{+0.075}_{+0.032}$	$3.5\,^{+0.5}_{0}$
	60	60	$18\,^{-0.018}_{-0.061}$	$4\,^{+0.5}_{0}$	$15\,^{+0.075}_{+0.032}$	$5\,^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions									Axial direction dimensions									
	A	B	C_1	C_2	C_3	E	F	Y	m	H	J	K	L_1	L_2	M_1	M_2	P	T	a
06	63	67.5	80	72	35	26	23	5	M4	24	3.5	2.1	43	31.5	22	15	7.3	6	0.2 ± 0.05
08	80	85	100	90	42	31	28.5	6	M5	26.5	4.3	2.6	51	35	24	20	8.3	8	0.2 ± 0.05
10	100	106	125	112	52	41	40	7	M5	30	5	3.1	61	41	27	25	9	10	0.2 ± 0.05
12	125	133	150	137	62	49	45	7	M6	33.5	5.5	3.6	70.5	46.5	30	30	9.3	12	$0.3\,^{+0.05}_{-0.1}$
16	160	169	190	175	80	65	62	9.5	M8	37.5	6	4.1	84.5	53.5	34	38	11.7	15	$0.3\,^{+0.05}_{-0.1}$
20	200	212.5	230	215	100	83	77	9.5	M8	44	7	5.1	100.5	64.5	40	45	13.4	18	$0.5\,^{0}_{-0.2}$
25	250	264	290	270	125	105	100	11.5	M10	51	8	6.1	118	75	47	54	16	22	$0.5\,^{0}_{-0.2}$

How to Place an Order

101-06-11G 24V R12DIN A12DIN

Size
Rotor bore diameter (dimensional symbol d1)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

CS Models Electromagnetic Clutches - Bearing-mounted Type

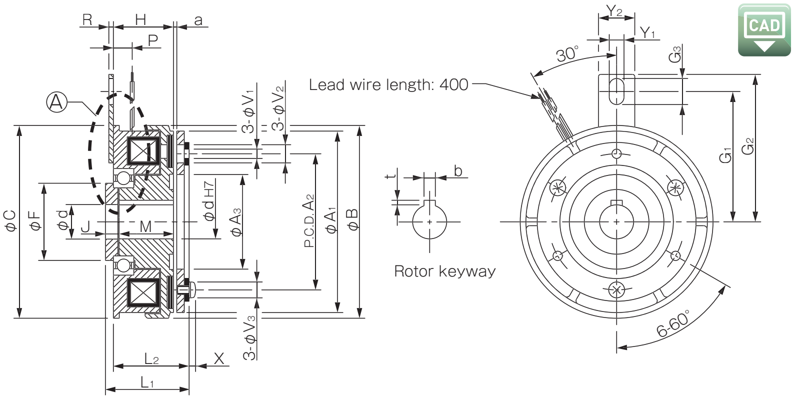
Specifications

Model	Size	Dynamic friction torque Td [N·m]	Static friction torque Ts [N·m]	Coil (at 20℃) Voltage [V]	Coil (at 20℃) Wattage [W]	Coil (at 20℃) Current [A]	Coil (at 20℃) Resistance [Ω]	Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J Rotor [kg·m²]	Rotating part moment of inertia J Armature [kg·m²]	Total work performed until readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque build-up time tp [s]	Torque decaying time td [s]	Mass [kg]
CS-06-33G	06	5	5.5	DC24	11	0.46	52	B	3000	7.35×10^{-5}	4.23×10^{-5}	36×10^6	0.020	0.041	0.020	0.50
CS-06-35G											1.05×10^{-4}					0.70
CS-06-31G											6.03×10^{-5}					0.54
CS-08-33G	08	10	11	DC24	15	0.63	38	B	3000	2.24×10^{-4}	1.18×10^{-4}	60×10^6	0.023	0.051	0.030	0.87
CS-08-35G											3.00×10^{-4}					1.23
CS-08-31G											1.71×10^{-4}					0.95
CS-10-33G	10	20	22	DC24	20	0.83	29	B	3000	6.78×10^{-4}	4.78×10^{-4}	130×10^6	0.025	0.063	0.050	1.57
CS-10-35G											9.45×10^{-4}					2.18
CS-10-31G											6.63×10^{-4}					1.73
CS-12-33G	12	40	45	DC24	25	1.09	23	B	2000	2.14×10^{-3}	1.31×10^{-3}	250×10^6	0.040	0.115	0.065	2.89
CS-12-35G											2.75×10^{-3}					3.93
CS-12-31G											1.81×10^{-3}					3.18
CS-16-33G	16	80	90	DC24	35	1.46	16	B	2000	6.30×10^{-3}	4.80×10^{-3}	470×10^6	0.050	0.160	0.085	5.3
CS-16-35G											9.05×10^{-3}					7.1
CS-16-31G											6.35×10^{-3}					5.6
CS-20-33G	20	160	175	DC24	45	1.88	13	B	1500	1.93×10^{-2}	1.37×10^{-2}	10×10^8	0.090	0.250	0.130	9.8
CS-25-33G	25	320	350	DC24	72	3.00	8	B	1500	4.48×10^{-2}	3.58×10^{-2}	20×10^8	0.115	0.335	0.210	17.5

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.
* The moment of inertia of a rotating body and mass are measured for the maximum bore diameter.

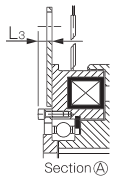
Dimensions (CS-□-33G)

(For direct mounting)



Unit [mm]

Size	Shaft bore dimensions				
	d H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
		b P9	t	b E9	t
06	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
08	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
12	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
20	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
25	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$



Section Ⓐ

Size	L3
20	9
25	6.8

* On sizes 20 and 25, the head of the bolt for pressing down the bearing will stick out. See the above dimensions.

Unit [mm]

Size	Radial direction dimensions														Axial direction dimensions								
	A_1	A_2	A_3	B	C	F	G_1	G_2	G_3	V_1	V_2	V_3	Y_1	Y_2	H	L_1	L_2	M	J	P	R	X	a
06	63	46	34.5	67.5	67.5	24	42.5	50	9.5	3.1	6.3	5.5	4.5	14	24	31	28	22	5	7.3	2	2.5	0.2 ± 0.05
08	80	60	41.5	85	85	34	57.5	65	11.5	4.1	8	7	6.5	16	26.5	34.5	31	24	6	8.3	2	2.85	0.2 ± 0.05
10	100	76	51.5	106	106	40	62.5	70	11.5	5.1	10.5	9	6.5	16	30	39.5	36	27	6.5	9	2	3.3	0.2 ± 0.05
12	125	95	61.5	133	133	45	77.5	85	11.5	6.1	12	11	6.5	16	33.5	44.5	40.5	30	7.5	9.3	2	3.3	$0.3^{+0.05}_{-0.1}$
16	160	120	79.5	169	169	58	100	112	18.5	8.1	15	14	8.5	25	37.5	50.5	46.5	34	7.5	11.7	3.2	3.5	$0.3^{+0.05}_{-0.1}$
20	200	158	99.5	212.5	212	75	125	138	18.5	10.2	18	16.2	8.5	25	44	60.5	55.5	40	9	13.4	3	5	$0.5^{0}_{-0.2}$
25	250	210	124.5	264	250	100	155	173	24	12.2	22	20	12	30	53	69	66	47	9	18	6	4.5	$0.5^{0}_{-0.2}$

* The V_1, V_2, and V_3 dimensions of size 25 are located in four places 90° apart.

How to Place an Order

CS-06-33G 24V 12DIN

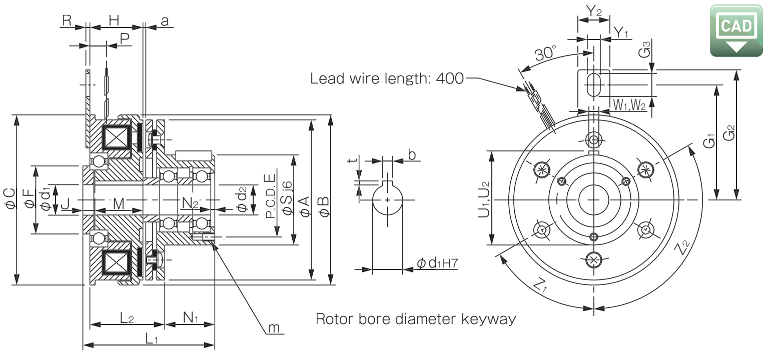
Size

Rotor bore diameter (dimensional symbol d)

Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Dimensions (CS-□-35G)

(For through-shafts)



Unit [mm]

Size	Shaft bore dimensions					
	d1 H7	d2	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
06	12	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
08	15	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
12	25	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions													Axial direction dimensions														
	A	B	C	E	F	G1	G2	G3	S	Y1	Y2	Z1	Z2	H	L1	L2	M	J	N1	N2	P	R	U1	W1	U2	W2	a	m
06	63	67.5	67.5	33	24	42.5	50	9.5	38	4.5	14	3-120°	0°	24	54.5	31.5	22	5	20	2	7.3	2	39.5	4	39.5	4	0.2 ±0.05	3-M4 × 0.7, length: 4
08	80	85	85	37	34	57.5	65	11.5	45	6.5	16	3-120°	0°	26.5	63.5	35	24	6	25	2	8.3	2	47	5	47	5	0.2 ±0.05	3-M4 × 0.7, length: 6
10	100	106	106	47	40	62.5	70	11.5	55	6.5	16	4-90°	45°	30	74.5	41	27	6.5	30	3	9	2	57	5	57.5	6	0.2 ±0.05	4-M4 × 0.7, length: 8
12	125	133	133	52	45	77.5	85	11.5	64	6.5	16	4-90°	45°	33.5	90.5	46.5	30	7.5	40	2	9.3	2	67	7	67	8	$0.3^{+0.05}_{-0.1}$	4-M4 × 0.7, length: 8
16	160	169	169	62	58	100	112	18.5	75	8.5	25	6-60°	30°	37.5	107.5	53.5	34	7.5	50	3	11.7	3.2	78	7	78	8	$0.3^{+0.05}_{-0.1}$	6-M5 × 0.8, length: 8

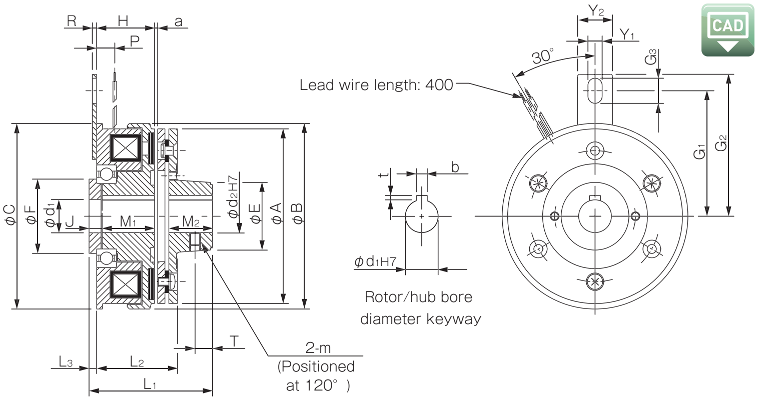
How to Place an Order

CS-06-35G 24V R12DIN A12JIS

Size
Rotor bore diameter (dimensional symbol)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)
Armature type-5 keyway standards
Dimensional symbol U2, W2: Compliant with the new JIS standards: DIN
Dimensional symbol U1, W1: Compliant with the old JIS standards: JIS

Dimensions (CS-□-31G)

(For butt shafts)



Unit [mm]

Size	Shaft bore dimensions					
	d1 H7	d2 H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
			b P9	t	b E9	t
06	12	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
08	15	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
12	25	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions											Axial direction dimensions										
	A	B	C	E	F	G1	G2	G3	Y1	Y2	m	H	L1	L2	L3	M1	M2	J	P	R	T	a
06	63	67.5	67.5	26	24	42.5	50	9.5	4.5	14	M4	24	46	31.5	3	22	15	5	7.3	2	6	0.2 ±0.05
08	80	85	85	31	34	57.5	65	11.5	6.5	16	M5	26.5	54.5	35	3.5	24	20	6	8.3	2	8	0.2 ±0.05
10	100	106	106	41	40	62.5	70	11.5	6.5	16	M5	30	64.5	41	3.5	27	25	6.5	9	2	10	0.2 ±0.05
12	125	133	133	49	45	77.5	85	11.5	6.5	16	M6	33.5	74.5	46.5	4	30	30	7.5	9.3	2	12	$0.3^{+0.05}_{-0.1}$
16	160	169	169	65	58	100	112	18.5	8.5	25	M8	37.5	88.5	53.5	4	34	38	7.5	11.7	3.2	15	$0.3^{+0.05}_{-0.1}$

How to Place an Order

CS-06-31G 24V R12DIN A12DIN

Size
Rotor bore diameter (dimensional symbol d1)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards
Armature bore diameter (dimensional symbol d2)
Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

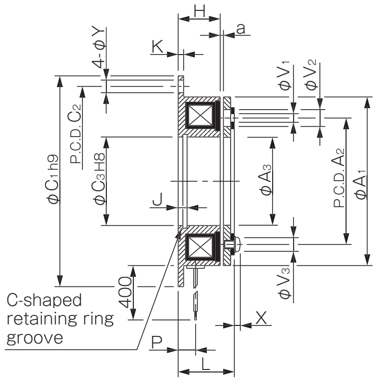
111 Models Electromagnetic Brakes

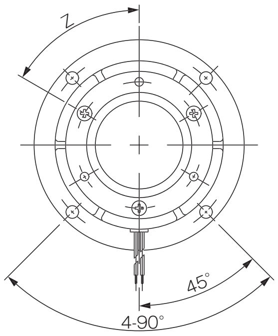
Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Armature Moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque rise time t_p [s]	Torque extinction time td [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
111-06-13G	06	5	5.5	DC24	11	0.46	52	B	8000	4.23×10^{-5}	36×10^6	0.015	0.033	0.015	0.28
111-06-12G										6.03×10^{-5}					0.32
111-06-11G										6.03×10^{-5}					0.32
111-08-13G	08	10	11	DC24	15	0.63	38	B	6000	1.18×10^{-4}	60×10^6	0.016	0.042	0.025	0.5
111-08-12G										1.71×10^{-4}					0.58
111-08-11G										1.71×10^{-4}					0.58
111-10-13G	10	20	22	DC24	20	0.83	29	B	5000	4.78×10^{-4}	130×10^6	0.018	0.056	0.030	0.91
111-10-12G										6.63×10^{-4}					1.07
111-10-11G										6.63×10^{-4}					1.07
111-12-13G	12	40	45	DC24	25	1.09	23	B	4000	1.31×10^{-3}	250×10^6	0.027	0.090	0.050	1.68
111-12-12G										1.81×10^{-3}					1.97
111-12-11G										1.81×10^{-3}					1.97
111-16-13G	16	80	90	DC24	35	1.46	16	B	3000	4.80×10^{-3}	470×10^6	0.035	0.127	0.055	3.15
111-16-12G										6.35×10^{-3}					3.45
111-16-11G										6.35×10^{-3}					3.45
111-20-13G	20	160	175	DC24	45	1.88	13	B	2500	1.37×10^{-2}	10×10^8	0.065	0.200	0.070	5.9
111-20-12G										1.90×10^{-2}					7.1
111-20-11G										1.90×10^{-2}					7.1
111-25-13G	25	320	350	DC24	60	2.5	9.6	B	2000	3.58×10^{-2}	20×10^8	0.085	0.275	0.125	10.5
111-25-12G										4.83×10^{-2}					12.2
111-25-11G										4.83×10^{-2}					12.2

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.
* The rotating part moment of inertia and mass are measured for the maximum bore diameter.

Dimensions (111-☐-13G)





Unit [mm]

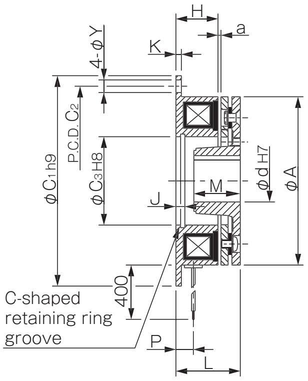
Size	Radial direction dimensions											Axial direction dimensions						
	A_1	A_2	A_3	C_1	C_2	C_3	V_1	V_2	V_3	Y	Z	H	J	K	L	P	X	a
06	63	46	34.5	80	72	35	3-3.1	3-6.3	3-5.5	5	6-60°	18	3.5	2.1	22	7.3	2.5	0.2 ± 0.05
08	80	60	41.5	100	90	42	3-4.1	3-8	3-7	6	6-60°	20	4.3	2.6	24.5	8.3	2.85	0.2 ± 0.05
10	100	76	51.5	125	112	52	3-5.1	3-10.5	3-9	7	6-60°	22	5	3.1	28	9	3.3	0.2 ± 0.05
12	125	95	61.5	150	137	62	3-6.1	3-12	3-11	7	6-60°	24	5.5	3.6	31	9.3	3.3	$0.3^{+0.05}_{-0.1}$
16	160	120	79.5	190	175	80	3-8.1	3-15	3-13	9.5	6-60°	26	6	4.1	35	11.7	3.5	$0.3^{+0.05}_{-0.1}$
20	200	158	99.5	230	215	100	3-10.2	3-18	3-17	9.5	6-60°	30	7	5.1	41.5	13.4	4.9	$0.5^{0}_{-0.2}$
25	250	210	124.5	290	270	125	4-12.2	4-22	4-20	11.5	8-45°	35	8	6.1	48	16	5.5	$0.5^{0}_{-0.2}$

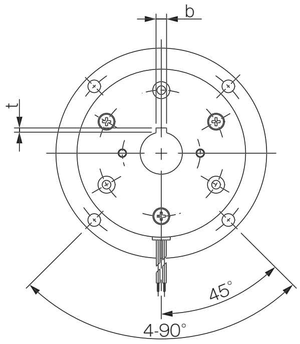
How to Place an Order

111-06-13G 24V

Size

Dimensions (111-☐-12G)





CAD

Unit [mm]

Size	d H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
		b P9	t	b E9	t
06	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
08	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
12	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
20	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
25	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
	60	$18^{-0.018}_{-0.061}$	$4^{+0.5}_{0}$	$15^{+0.075}_{+0.032}$	$5^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions					Axial direction dimensions						
	A	C_1	C_2	C_3	Y	H	J	K	L	M	P	a
06	63	80	72	35	5	18	3.5	2.1	25.5	15	7.3	0.2 ±0.05
08	80	100	90	42	6	20	4.3	2.6	28.5	20	8.3	0.2 ±0.05
10	100	125	112	52	7	22	5	3.1	33	25	9	0.2 ±0.05
12	125	150	137	62	7	24	5.5	3.6	37	30	9.3	$0.3^{+0.05}_{-0.1}$
16	160	190	175	80	9.5	26	6	4.1	42	38	11.7	$0.3^{+0.05}_{-0.1}$
20	200	230	215	100	9.5	30	7	5.1	50.5	45	13.4	$0.5^{0}_{-0.2}$
25	250	290	270	125	11.5	35	8	6.1	59	54	16	$0.5^{0}_{-0.2}$

How to Place an Order

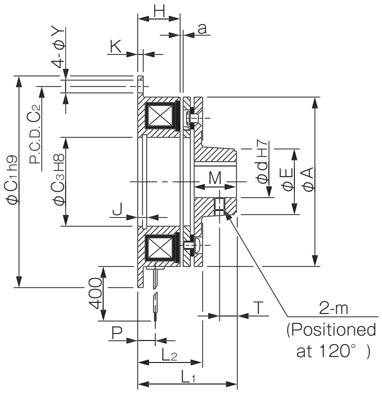
111-06-12G 24V 12DIN

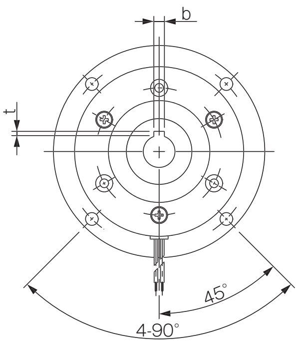
Size

Armature bore diameter (dimensional symbol d)

Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Dimensions (111-☐-11G)





CAD

Unit [mm]

Size	d H7	Models compliant with the new JIS standards		Models compliant with the old JIS standards	
		b P9	t	b E9	t
06	12	$4^{-0.012}_{-0.042}$	$1.5^{+0.5}_{0}$	$4^{+0.050}_{+0.020}$	$1.5^{+0.5}_{0}$
	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
08	15	$5^{-0.012}_{-0.042}$	$2^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
10	20	$6^{-0.012}_{-0.042}$	$2.5^{+0.5}_{0}$	$5^{+0.050}_{+0.020}$	$2^{+0.5}_{0}$
	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
12	25	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
16	30	$8^{-0.015}_{-0.051}$	$3^{+0.5}_{0}$	$7^{+0.061}_{+0.025}$	$3^{+0.5}_{0}$
	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
20	40	$12^{-0.018}_{-0.061}$	$3^{+0.5}_{0}$	$10^{+0.061}_{+0.025}$	$3.5^{+0.5}_{0}$
	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
25	50	$14^{-0.018}_{-0.061}$	$3.5^{+0.5}_{0}$	$12^{+0.075}_{+0.032}$	$3.5^{+0.5}_{0}$
	60	$18^{-0.018}_{-0.061}$	$4^{+0.5}_{0}$	$15^{+0.075}_{+0.032}$	$5^{+0.5}_{0}$

Unit [mm]

Size	Radial direction dimensions							Axial direction dimensions							
	A	C_1	C_2	C_3	E	Y	M	H	J	K	L_1	L_2	M	P	T	a
06	63	80	72	35	26	5	M4	18	3.5	2.1	37	25.5	15	7.3	6	0.2 ±0.05
08	80	100	90	42	31	6	M5	20	4.3	2.6	44.5	28.5	20	8.3	8	0.2 ±0.05
10	100	125	112	52	41	7	M5	22	5	3.1	53	33	25	9	10	0.2 ±0.05
12	125	150	137	62	49	7	M6	24	5.5	3.6	61	37	30	9.3	12	$0.3^{+0.05}_{-0.1}$
16	160	190	175	80	65	9.5	M8	26	6	4.1	73	42	38	11.7	15	$0.3^{+0.05}_{-0.1}$
20	200	230	215	100	83	9.5	M8	30	7	5.1	86.5	50.5	45	13.4	18	$0.5^{0}_{-0.2}$
25	250	290	270	125	105	11.5	M10	35	8	6.1	102	59	54	16	22	$0.5^{0}_{-0.2}$

How to Place an Order

111-06-11G 24V 12DIN

Size

Armature bore diameter (dimensional symbol d)

Keyway standards DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

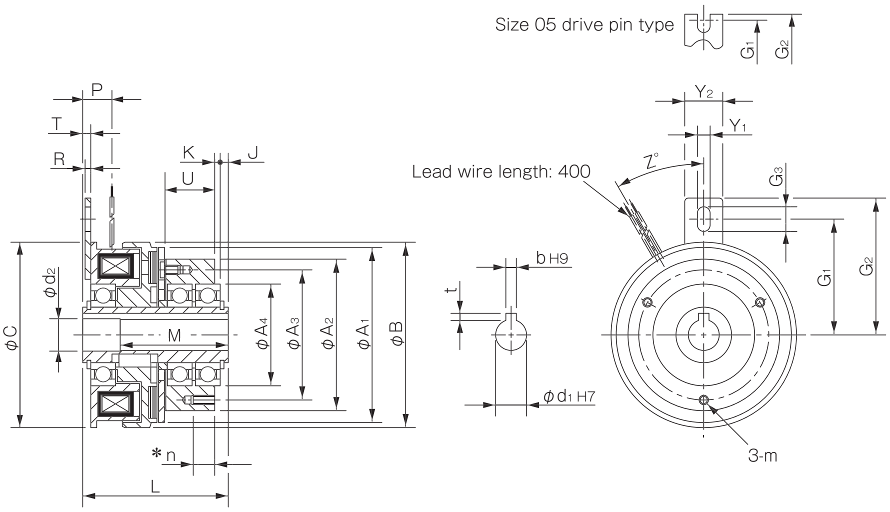
CSZ Models Electromagnetic Clutches - One-touch-mounted Type

Specifications

Model	Size	Dynamic friction torque Td [N·m]	Static friction torque Ts [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia		Total work until readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque build-up time tp [s]	Torque decaying time td [s]	Mass [kg]	Bearing used
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			Rotor [kg·m²]	Armature [kg·m²]						
CSZ-05-35	05	2.4	2.4	DC24	10	0.42	57	B	1800	2.87×10^{-5}	2.43×10^{-5}	9×10^6	0.017	0.035	0.023	0.38	6902ZZ
CSZ-06-35	06	5	5.5	DC24	11	0.46	52	B	1800	8.94×10^{-5}	7.57×10^{-5}	29×10^6	0.023	0.050	0.010	0.67	6904ZZ
CSZ-08-35	08	10	11	DC24	15	0.63	38	B	1800	2.41×10^{-4}	2.08×10^{-4}	60×10^6	0.025	0.064	0.020	1.23	6906ZZ

* The dynamic friction torque, Td, is measured at a relative speed of 100 min⁻¹.

Dimensions



Unit [mm]

Size	Shaft bore dimensions			
	d_1 H7	d_2	b H9	t
05	10	10.2	$3^{+0.030}_{0}$	$1.2^{+0.3}_{0}$
06	12	12.2	$4^{+0.030}_{0}$	$1.8^{+0.3}_{0}$
08	15	15.5	$5^{+0.030}_{0}$	$2.3^{+0.3}_{0}$

Unit [mm]

Size	Radial direction dimensions											Axial direction dimensions										
	A_1	A_2	A_3	A_4	B	C	G_1	G_2	G_3	Y_1	Y_2	J	K	L	M	P	R	T	U	Z	m	n*
05	50	47	38	$28^{\ 0}_{-0.009}$	54	50	28	31	—	3.1	8	2.1	2	47.2	33	7.9	1.6	1.9	14	180	M4	6
06	63	55	46	$37^{\ 0}_{-0.011}$	67.5	67.5	42.5	50	9.5	4.5	14	2.5	2.3	53.5	40	9.8	2	2.5	18	30	M4	6
08	80	70	60	$47^{\ 0}_{-0.011}$	85	85	57.5	65	11.5	6.5	16	3	2.5	58	43	11.5	2	3	18.5	30	M4	8

* For bolts mounted on clutch hubs marked with an asterisk, select a length no greater than the n dimension.

How to Place an Order

CSZ-05-35

Size

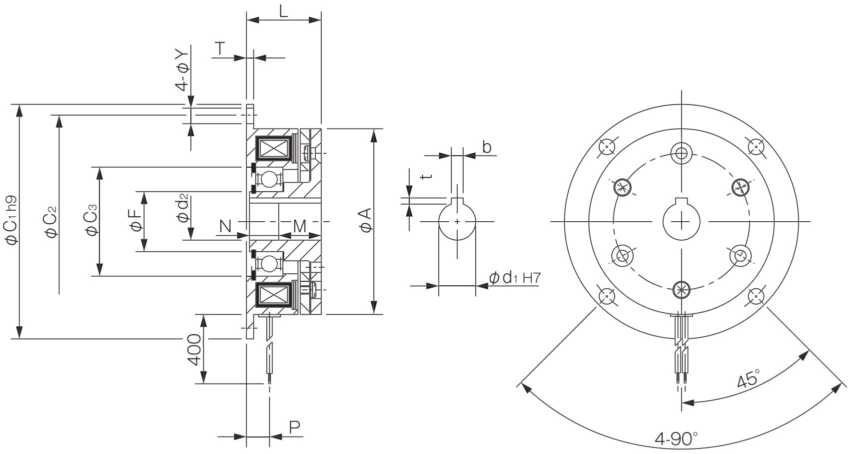
BSZ Models Electromagnetic Brakes - One-touch-mounted Type

Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃) Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Heat resistance class	Max. rotation speed [min⁻¹]	Armature Moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]	Bearing used
BSZ-05-12	05	2.4	2.4	DC24	10	0.42	57	B	1800	1.46×10^{-5}	9×10^{6}	0.020	0.030	0.010	0.25	6902ZZ
BSZ-06-12	06	5	5.5	DC24	11	0.46	52	B	1800	5.77×10^{-5}	29×10^{6}	0.017	0.033	0.010	0.36	6904ZZ
BSZ-08-12	08	10	11	DC24	15	0.63	38	B	1800	1.63×10^{-4}	60×10^{6}	0.020	0.052	0.015	0.67	6905ZZ

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions



Unit [mm]

Size	Radial direction dimensions					Axial direction dimensions					Shaft bore dimensions				
	A	C_1	C_2	C_3	F	L	M	N	P	T	Y	d_{1H7}	d_2	b_{H9}	t
05	50	65	58	28	15	28.3	18	9.8	8.2	2	3.4	10	10.2	$3^{+0.030}_{0}$	$1.2^{+0.3}_{0}$
06	63	80	72	37	20	25.5	15	10	7.3	2	5	12	12.2	$4^{+0.030}_{0}$	$1.8^{+0.3}_{0}$
08	80	100	90	42	25	28.5	20	8	8.3	2.6	6	15	15.5	$5^{+0.030}_{0}$	$2.3^{+0.3}_{0}$

How to Place an Order

BSZ-05-12

Size

ELECTROMAGNETIC CLUTCH AND BRAKE UNITS

Application	Printing machinery, bookbinding machinery, woodworking machinery, semiconductor manufacturing equipment

Connection and Release, Required Functions Integrated in a Compact Form Factor, Electromagnetic Clutch and Brake Units

Multiple clutches and brakes are required when designing complex actions. You can select from our clutch and brake units to get the operation you require rather than just combine as many clutches and brakes you need. We provide not just clutch and brake combinations, but total solutions that also include motors, speed reducers and the like.

Available Models

Series	Clutches & Brakes	Structure	Lineup
CLUTCH AND BRAKE UNITS	Clutch and brake units	Butt shaft construction, drip-proof type	125
		Through-shaft construction, open-disc brake system type	121-□-20G
		Motor-coupled type	126
		Speed reducer-integrated type	CBW
		Motor/speed reducer integrated type	CMW
	Double-clutch units		121-□-10G
	Double clutch and brake units		122

Model Selection

Model/Type	Torque [N·m]	Device		Shaft structure		Unitized construction		Position control	Forward/ reverse operation	Two-step speed changing
		Clutch	Brake	Through-shaft	Butt shaft	Motor	Speed reducer			
125	2.4 ～ 160	◎	◎		◎			◎		
121-□-20G	5 ～ 320	◎	◎	◎				◎		
126	5 ～ 80	◎	◎		◎	◎		◎		
CBW	5 ～ 40	◎	◎	◎			◎	◎		
CMW	5 ～ 40	◎	◎	◎		◎	◎	◎		
121-□-10G	5 ～ 320	◎ (Double clutch)		◎					◎	◎
122	5 ～ 160	◎ (Double clutch)	◎	◎				◎	◎	◎

For details on selection, see P.308.

Product Lineup

125

RoHS-compliant
(125-□-12G only)

Butt shaft construction, drip-proof type

Handling is made simpler by drip-proof construction that encloses clutch and brake inside a light alloy housing.

Mounting direction freedom

Disc springs are used, so this clutch/brake unit can be used vertically.

This design preserves the performance of clutch and brake to the maximum extent. Its construction is sturdy, yet lightmass. Its easy-to-use butt-connected construction is drip proof, making it suitable for a variety of general industrial machinery applications. The base can be either steel plate or cast (E type made to order). Mounting is simple and service life is long.

Unit types		125-□-12G	125-□-12E
Clutch/brake torque	[N·m]	2.4～80	5～160
Operating temperature	[℃]	−10～+40	
Backlash		Zero	

121-□-20G

RoHS-compliant

Through-shaft construction, open-disc brake system type

These are open-disc brake system type with clutch and brake mounted on the outside of a light alloy drum. They use through-shaft construction.

Ideal for winding or geared transmission

The construction holds up well under radial loads due to a wide bearing span, so they can be used under high tension when mounted with V pulleys, spur gears or the like.

Output shaft can be used in many applications

Through-shaft construction means that output is available on both sides of the shaft. Many mechanism layouts are possible, including using both ends in split driving or mounting a detection disc or the like on one end.

This design preserves the performance of clutch and brake to the maximum extent. Its construction is sturdy, yet lightmass. Its compact through-shaft construction is open, making it suitable for a variety of general industrial machinery applications. Mounting is simple and service life is long.

Clutch/brake torque	[N·m]	5～320
Operating temperature	[℃]	−10～+40
Backlash		Zero

126

Easy to mount and handle

These types directly connect 3-phase induction motors to clutch/brake units, requiring less installation space and eliminating cumbersome tasks such as centering and processing of mounts. Since the output shaft is simply engaged to the load, handling is easy.

Capable of high-frequency operation

These can repeatedly start and stop the output shaft without stopping the motor, so they can operate intermittently at a higher frequency than on/off operation of the motor.

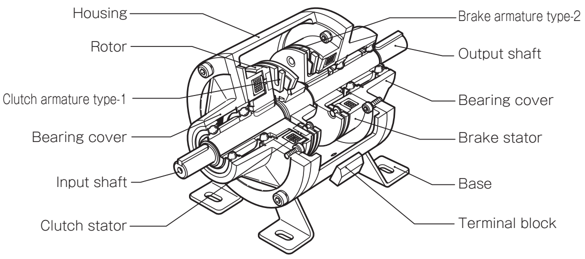
Two ways to mount

Base and flange types are available. Decide which to use based on your installation location. Flange mountings have the same shape mounting surface as general-purpose flange motors, so they can be integrated with speed reducers.

These are practical units in which induction motors are directly connected to clutch/brake units in advance. Base and flange types are available.

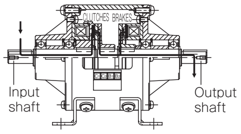
Unit types		126-□-4B	126-□-4F-N
Clutch/brake torque	[N·m]	5～80	
Operating temperature	[℃]	−10～+40	
Backlash		Zero	
Motor output	[kW]	0.2 to 3.7 3-phase 4-pole fully-sealed external fan type	

Structure



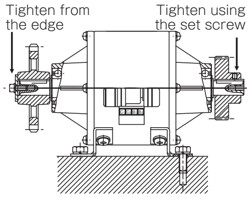
Power transmission

Input and output shafts are isolated. A pulley or the like is mounted on the input shaft, connecting it to the driver so it is always rotating. When electricity flows to the clutch, the two shafts are connected, and rotation is transmitted. If the brake mounted on the output shaft is supplied with electricity simultaneous with clutch current being shut off, the input and output shafts are isolated and the output shaft is quickly braked.

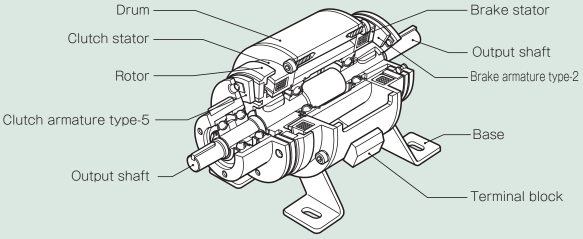


Mounting

The end faces of the input and output shafts are equipped with screw holes, so pulleys and the like can be easily mounted using jig accessories. They are attached by screwing them in from the end face or by using a set screw.

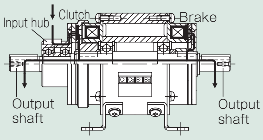


Structure



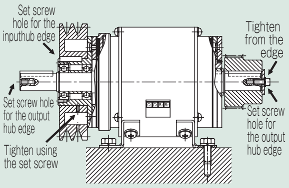
Power transmission

The input hub floats on the shaft on bearings, is connected to the drive by mounting pulleys or the like, and is always rotating. When electricity flows to the clutch, the output shaft is connected, and rotation is transmitted. If a brake mounted on the output shaft is supplied with electricity simultaneous with clutch current being shut off, the input and output shafts are isolated and the output shaft is quickly braked. They have excellent response performance, so they are capable of high-frequency intermittent operation.

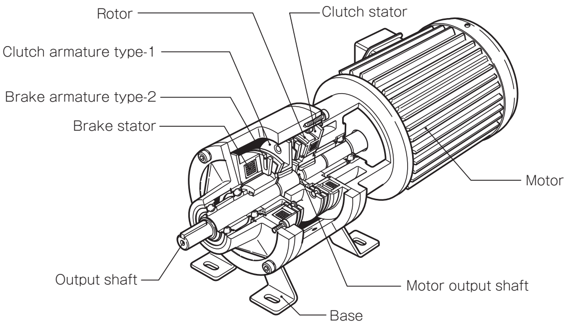


Mounting

The input hub and output shaft end face have screw holes, so they are pushed into each other using a jig accessory. Lock them in place either using a set screw or by pressing from the end face.

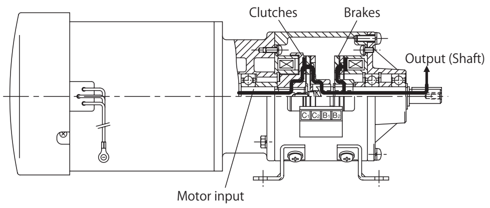


Structure



Power transmission

The motor shaft serves as the clutch input shaft, while the output shaft is isolated. When current flows to the clutch, the motor's rotation is transmitted to the output shaft via the clutch. If the brake is supplied with electricity simultaneous with clutch current being shut off, the output shaft is isolated from the motor side and instantly stopped.



Product Lineup

CBW

Compact, space saving

These are very compact units that combine a worm reducer and clutch/brake in a single unit. They can greatly save on space required for mounting.

Easy to mount and handle

A V pulley comes mounted as standard on the input part, so simply connect it to a drive with a belt. Install the speed reducer to complete the mounting. No troublesome centering or processing is needed.

Efficient starting and stopping

Integration keeps self-inertia low, so the efficiency of starting and stopping is good. It can be combined with a speed changer for a wide range of speed changes, and excellent performance can be achieved in many applications, such as 360° rotation stop of the output shaft.

These are practical units in which worm reducers are directly connected to clutch/brake units in advance. A standard V belt pulley is installed on the input part of the clutch. Two models are available, based on worm reducer type.

Unit types	CBW-□N-H□	CBW-□N-B□
Speed reducer manufacturer	Hirai Reduction Gear Manufacturing Co.	Bellpony Co., Ltd.
Clutch/brake torque [N·m]	5～40	
Operating temperature [℃]	0～＋40	
Backlash	Zero (clutch/brake units)	

CMW

Easy to mount and handle

These types integrate induction motors, clutch/brake units, couplings, and speed reducers in a single unit, requiring less installation space and eliminating cumbersome tasks such as centering and processing of mounts. Since the output shaft is simply engaged to the load, handling is easy.

Efficient starting and stopping

Integration keeps self-inertia low, so the efficiency of starting and stopping is good.

Capable of high-frequency operation

These can repeatedly start and stop the output shaft without stopping the motor, so they can operate intermittently at a higher frequency than on/off operation of the motor.

These are practical units in which motors, clutch/brake units, and speed reducers are combined into a single unit in advance. An induction motor and a clutch are coupled by a MIKI PULLEY CENTAFLEX coupling, which features shock absorption, and then combined in a unit with a worm reducer to make a multifunction drive unit.

Clutch/brake torque [N·m]	5～40
Operating temperature [℃]	0～＋40
Backlash	Zero (clutch/brake units)
Motor output [kW]	0.2 to 1.5 3-phase 4-pole fully-sealed external fan type

121-□-10G

RoHS-compliant

Compact through-shaft construction

This is an efficient unit whose basic design is the same as that of clutch/brake type 121. It is a strong construction for winding, gear transmission, and the like.

Multi-function unit

This single unit can perform functions such as two-step speed changing, forward/reverse operation, and power distribution, so the transmission mechanism can be simplified.

These are compact, open units that place two clutches (101-□-15) on a through-shaft. Since one unit can perform many functions, and is also easy to install and handle, the transmission mechanism can be simplified.

Clutch torque [N·m]	5～320
Operating temperature [℃]	－10～＋40
Backlash	Zero

122

RoHS-compliant

Compact through-shaft construction

These unique units have everything placed extremely skilfully on the through-shaft. They are suitable for winding, gear transmission, and the like.

Multi-function unit

These multifunction units perform complex and precision control in a single unit, including two-step speed changing, stopping at predetermined positions, and high-frequency forward/reverse operation. The transmission mechanism can be greatly simplified.

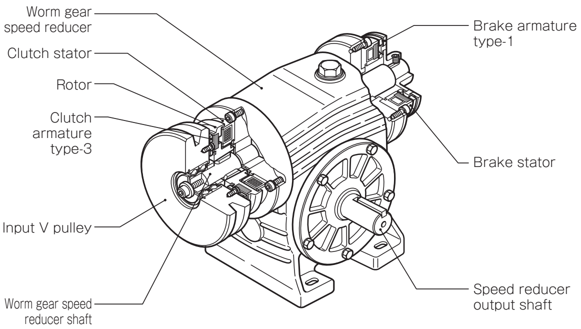
Easy handling

They not only perform many functions, they also are easy to build into machinery, just like other units.

These are units unlike any other, which combine two clutches (101- □ -15G) with a brake (111- □ -12G) in a compact form factor. They provide high-precision positioning and applied control of complex operations from a single unit. Installation and handling are as easy as on other units.

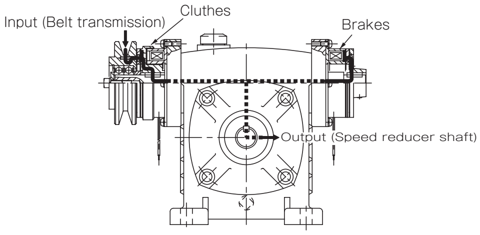
Clutch/brake torque [N·m]	5～160
Operating temperature [℃]	－10～＋40
Backlash	Zero

Structure

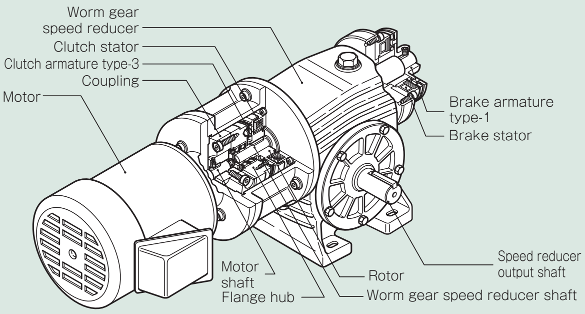


Power transmission

A V pulley is installed on the input part of the clutch, connected by a belt to the drive, and rotates continuously. When current flows to the clutch, rotation is transmitted to the worm shaft, and the output shaft of the speed reducer rotates. If the brake is supplied with electricity when clutch current is shut off, the output shaft stops.

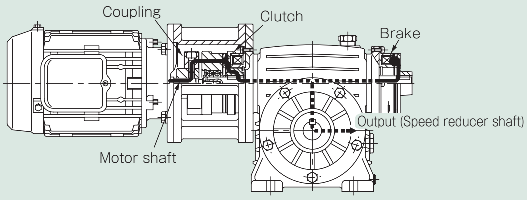


Structure

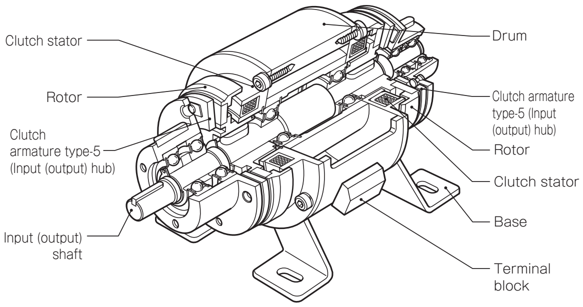


Power transmission

The motor shaft becomes the clutch input shaft via a CENTAFLEX coupling, and the worm shaft is isolated. When current flows to the clutch, the motor's rotation is transmitted to the worm shaft via the clutch, and the output shaft of the speed reducer rotates. If the brake is supplied with electricity when clutch current is shut off, the output shaft stops.

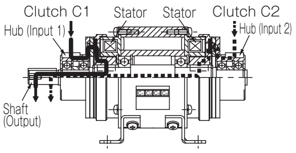


Structure



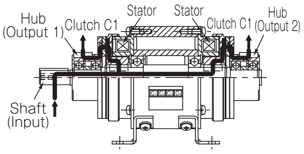
Power transmission

Two clutches, C1 and C2, have a hub shape on the armature side; a V pulley or the like is installed on each. When the hub is used as the input, different force power is connected to the two hubs and they rotate continuously. When current runs to clutch C1, power is transmitted to the shaft via the rotor. When C1 current is shut off and current simultaneously sent to C2, the power switches quickly and the new power is transmitted to the shaft. When the shaft is used as the input, the drive and shaft engage and rotation is continuous. When current flows to the clutches, power is transmitted via the armature to the hub that serves as output.

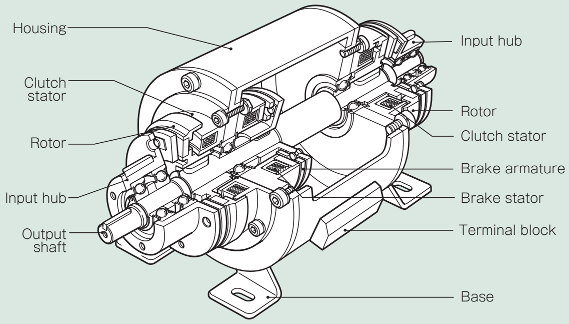


Mounting

Installation of these units and mounting of components and the like is the same as for 121-□-20G type clutch/brake units.

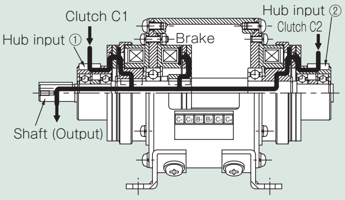


Structure



Power transmission

Different force power is connected to the input hubs of the two clutches C1 and C2 to make them rotate continuously. When current flows to clutch C1, that power is transmitted and the output shaft rotates. When C1 current is shut off and current simultaneously sent to C2, power switches quickly and the new power is transmitted to the shaft. If the brake is supplied with electricity simultaneous with clutch current being shut off, the shaft is instantly stopped.



Mounting

Installation of these units and mounting of components and the like is the same as for 121-□-20G type clutch/brake units.

Customization

Examples of Special Cases

■ Special friction material (lining) specifications

In addition to standard friction materials, high-torque friction materials and long-life friction materials can also be handled. When using non-standard friction materials, the friction torque and total work will differ from catalog specifications tables. Contact Miki Pulley for details.

■ Special voltage specifications

The standard voltage of clutch and brakes is DC 24 V. Special voltages such as DC 12 V, 90 V and 180 V can also be handled.

■ New JIS standard compliance for input and output shafts

Input/output shaft parts other than those of 126-□-4F-N, CBW-□N-□, and CMW-□N-H□H are compliant with old JIS standards. They can also be made compliant with new JIS standards. Contact Miki Pulley for details.

* Please understand that we may not be able to meet all such special specifications, depending on the usage conditions, dimensional restrictions, clutch and brake sizes, mounting restrictions and the like.

■ V pulleys, sprockets, etc.

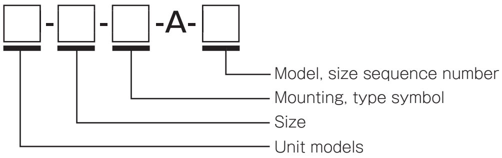
Input and output components that meet your needs, for example, by having V pulleys (including with different pulley diameters), sprockets, or timing pulleys, can be designed and produced.

■ Integrated or unitized products

We can also produce units that combine motors, speed reducers, couplings and the like to meet your needs.

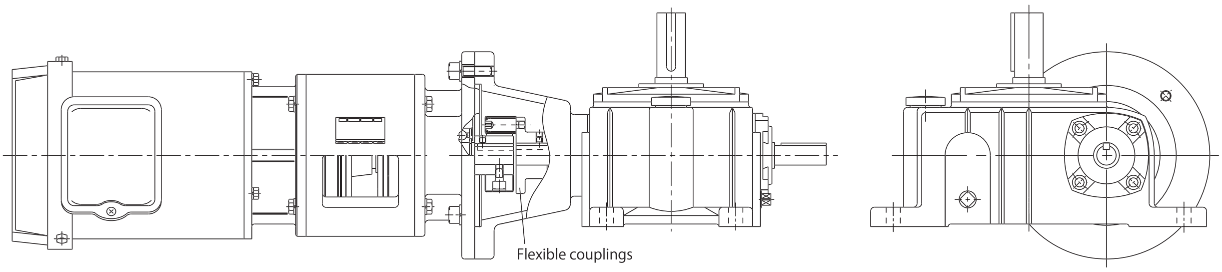
How to Place an Order

After exchanging delivery specifications for designing a product to meet your particular requirements (special production), we will custom manufacture it using the type name at right.

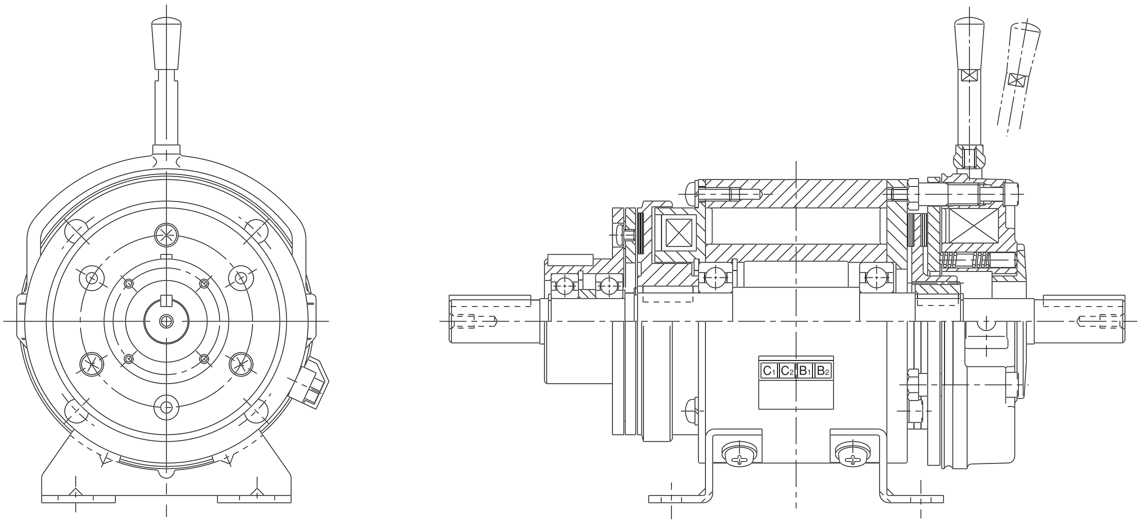


Special Application Examples

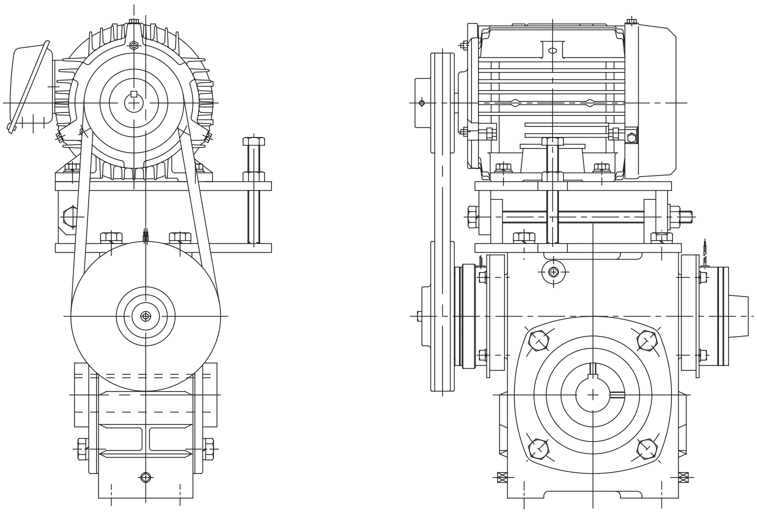
Integrated unit that uses a coupling to connect a 126 model with an above-shaft worm reducer



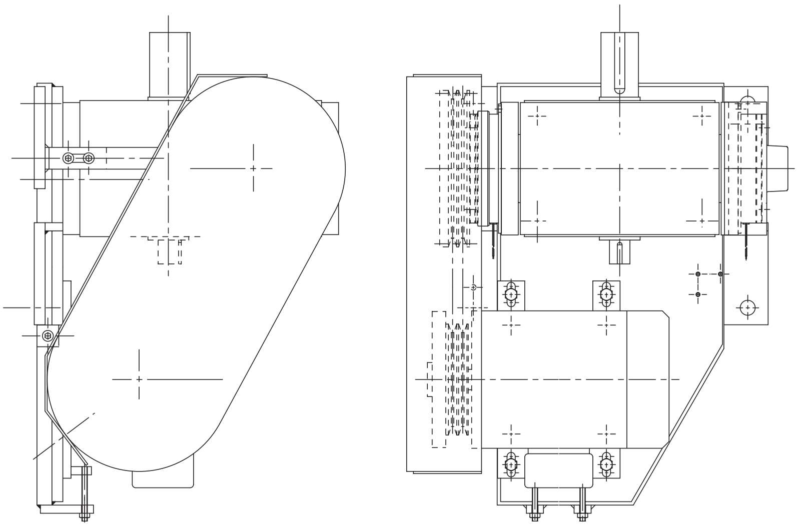
Unit that uses a spring-actuated brake as the brake of a model 121 clutch/brake unit



Integrated drive unit that connects a motor and special type of CBW model (hollow-shaft worm reducer) with a belt



Integrated drive unit, covered with a safety cover, that connects a motor and a special CBW model worm reducer with a belt



For details, please visit our website.

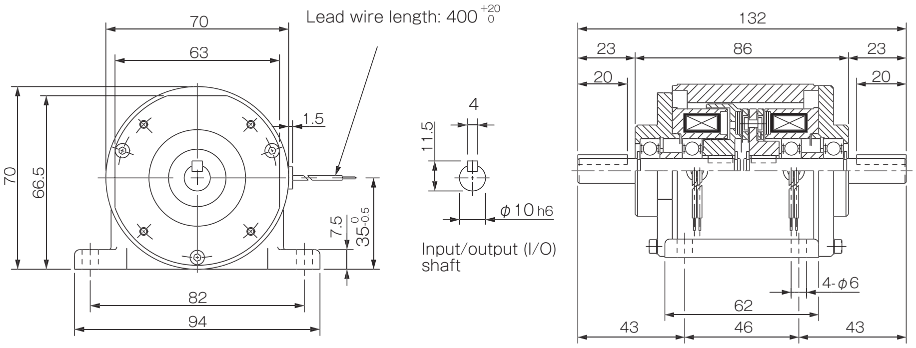
125 Models   Clutch/Brake Units

Specifications (125-□-12G)

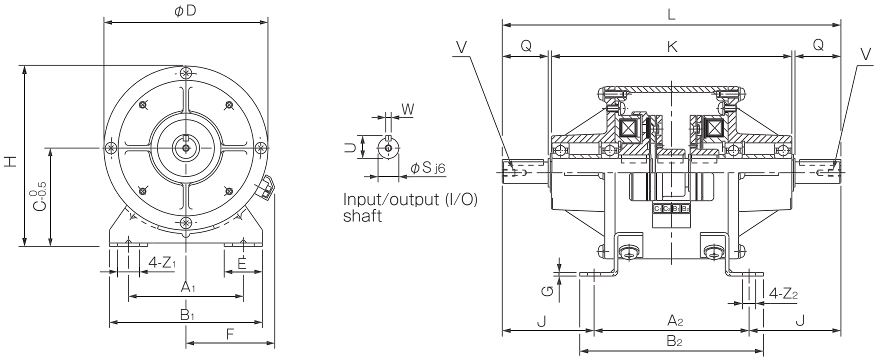
Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃) Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
125-05-12G	05	2.4	—	DC24	10	0.42	58	B	3000	2.4×10^{-5}	9×10^6	C:0.012 B:0.010	C:0.031 B:0.023	C:0.040 B:0.012	1.2
125-06-12G	06	5	5.5	DC24	11	0.46	52	B	3000	1.28×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	2.1
125-08-12G	08	10	11	DC24	15	0.63	38	B	3000	3.70×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	4.2
125-10-12G	10	20	22	DC24	20	0.83	29	B	3000	1.40×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	6.8
125-12-12G	12	40	45	DC24	25	1.09	23	B	3000	3.85×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	12
125-16-12G	16	80	90	DC24	35	1.46	16	B	3000	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	22

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions (125-05-12G)



Dimensions (125-□-12G)



Unit [mm]

Size	Dimensions of part															Dimensions of shaft				
	A_1	A_2	B_1	B_2	C	D	E	F	G	H	J	K	L	Z_1	Z_2	Q	S	U	V	W
06	65	90	90	105	65	100	27.5	61	2.6	115	48.5	132	187	13.5	6.5	25	11	12.5	M4 × 0.7, length: 8	4
08	80	110	110	130	80	125	32.5	72	3.2	142.5	63	171	236	15.5	9	30	14	16	M4 × 0.7, length: 8	5
10	105	135	140	160	90	150	35	81	3.2	165	80	210	295	20	11.5	40	19	21	M6 × 1, length: 11	5
12	135	160	175	185	112	190	42.5	97	4.5	207	108	270	376	24	11	50	24	27	M6 × 1, length: 11	7
16	155	200	200	230	132	230	45	109	6	247	145	362	490	28	14	60	28	31	M6 × 1, length: 11	7

* The input/output shaft keyways are old JIS standard class 2 while the key is old JIS standard class 1.
* When inserting pulleys or the like onto input/output shafts, use the supplied insertion set.

How to Place an Order

125-06-12G

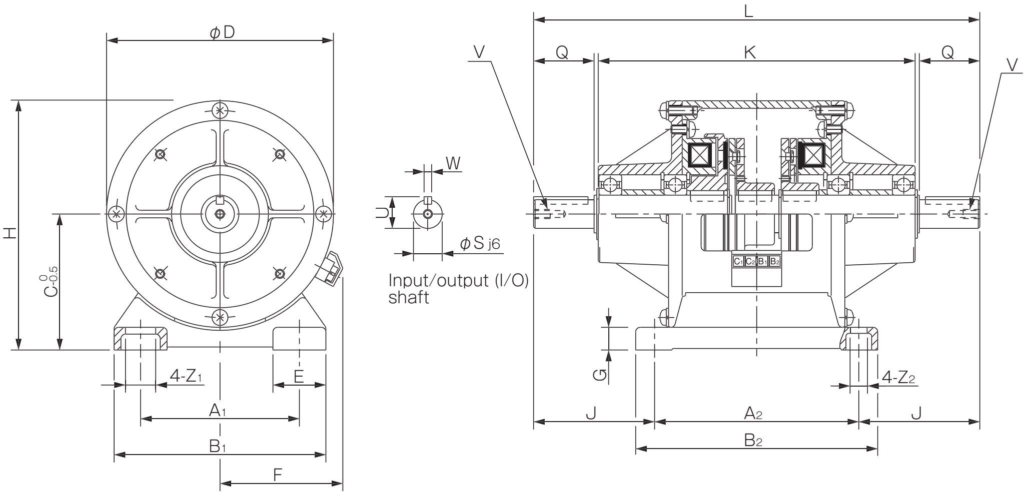
Size ── 06

Specifications (125-□-12E) Made to Order

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque rise time t_p [s]	Torque extinction time t_d [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
125-06-12E	06	5	5.5	DC24	11	0.46	52	B	3000	1.28×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	2.1
125-08-12E	08	10	11	DC24	15	0.63	38	B	3000	3.70×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	4.2
125-10-12E	10	20	22	DC24	20	0.83	29	B	3000	1.40×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	6.8
125-12-12E	12	40	45	DC24	25	1.09	23	B	3000	3.85×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	12
125-16-12E	16	80	90	DC24	35	1.46	16	B	3000	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	22
125-20-12E	20	160	175	DC24	45	1.86	13	B	2500	4.08×10^{-2}	10×10^5	C:0.090 B:0.065	C:0.250 B:0.207	C:0.130 B:0.070	49

*The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions (125-□-12E) Made to Order



Unit [mm]

Size	Dimensions of part															Dimensions of shaft				
	A₁	A₂	B₁	B₂	C	D	E	F	G	H	J	K	L	Z₁	Z₂	Q	S	U	V	W
06	65	90	90	105	65	100	27.5	61	10	115	48.5	132	187	13.5	6.5	25	11	12.5	M4 × 0.7, length: 8	4
08	80	110	110	130	80	125	32.5	72	12	142.5	63	171	236	15.5	9	30	14	16	M4 × 0.7, length: 8	5
10	105	135	140	160	90	150	35	81	15	165	80	210	295	20	11.5	40	19	21	M6 × 1, length: 11	5
12	135	160	175	185	112	190	42.5	97	15	207	108	270	376	24.5	11	50	24	27	M6 × 1, length: 11	7
16	155	200	200	230	132	230	45	109	18	247	145	362	490	28	14	60	28	31	M6 × 1, length: 11	7
20	195	240	240	270	160	290	47.5	124	20	305	188	448	616	28	14	80	38	41.5	M10 × 1.5, length: 17	10

* The input/output shaft keyways are old JIS standard class 2 while the key is old JIS standard class 1.
* When inserting pulleys or the like onto input/output shafts, use the supplied insertion set.

How to Place an Order

125-06-12E

Size

Base casting (Made to Order): E

125 Models

List of Stand-alone Clutches and Brakes Used

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	
			Input part	Output part
125-05-12	-	-	6000	6000
125-06-12	101-06-11G 24V R15JIS A15JIS	111-06-12G 24V 15JIS	6202	6202
125-08-12	101-08-11G 24V R20JIS A20JIS	111-08-12G 24V 20JIS	6004	6004
125-10-12	101-10-11G 24V R25JIS A25JIS	111-10-12G 24V 25JIS	6205	6205
125-12-12	101-12-11G 24V R30JIS A30JIS	111-12-12G 24V 30JIS	6206	6206
125-16-12	101-16-11G 24V R40JIS A40JIS	111-16-12G 24V 40JIS	6208	6208
125-20-12	101-20-11G 24V R50JIS A50JIS	111-20-12G 24V 50JIS	6211	6211

Recommended Power Supplies and Accessory Parts

Model	Recommended power supplies	Accessory parts			
		Circuit protector (Varistor), qty. 2	Tightening collar	Screw stock	Hexagonal nut
125-05-12	BEH-10G	NVD07SCD082 or an equivalent	-	-	-
125-06-12	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55 (hex-socket bolt), qty. 1	M4, qty. 1
125-08-12	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55 (hex-socket bolt), qty. 1	M4, qty. 1
125-10-12	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
125-12-12	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
125-16-12	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
125-20-12	BEH-20G	NVD07SCD082 or an equivalent	Qty. 1	M10 × 160, qty. 1	M10, qty. 2

* NVD□SCD□ parts are manufactured by KOA Corporation.

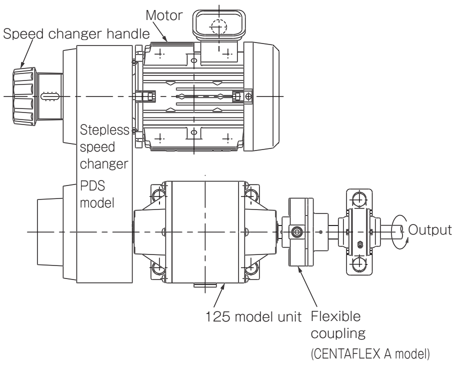
* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

Mounting Example

In Combination with Speed Changers

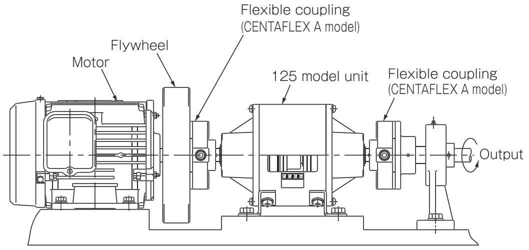
Clutches and brakes are generally used after motors and speed changers. This unit was designed so that it can be used in combination with a Miki Pulley belt-type stepless speed changer.

We provide items precombined into sets. Contact Miki Pulley for details.



Examples of Direct Connection to Motors

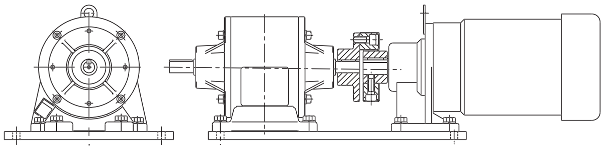
Couplings generally have small inertial moments compared to pulleys, sprockets and the like, so they are often used in combination with clutches and brakes. This unit is often combined with our flexible couplings (CENTAFLEX) in particular. It is very effective to mount it on the motor side in combination with a flywheel.



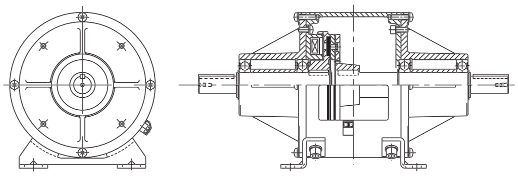
Special Types

In addition to the special application examples shown below, drivers can also be set, and units can be provided with pulleys, sprockets, and the like. Contact Miki Pulley for details.

One-piece Unit Connected to Geared Motor and Coupling



Clutch Unit (No Brake)



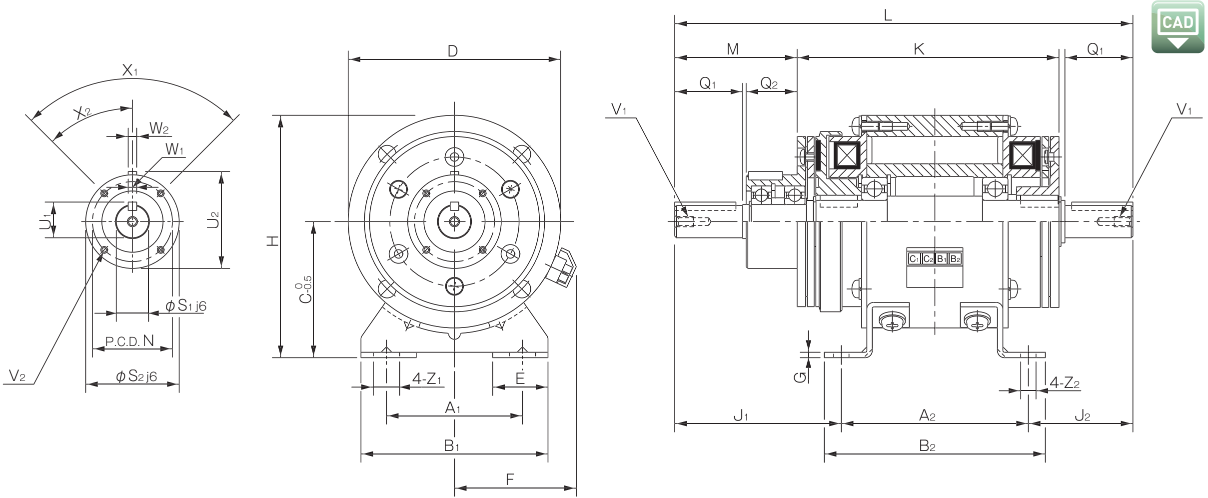
121-□-20G Types Clutch/Brake Units

Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
121-06-20G	06	5	5.5	DC24	11	0.46	52	B	3000	1.43×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	1.5
121-08-20G	08	10	11	DC24	15	0.63	38	B	3000	4.23×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	2.7
121-10-20G	10	20	22	DC24	20	0.83	29	B	3000	1.42×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	5.5
121-12-20G	12	40	45	DC24	25	1.09	23	B	3000	4.18×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	9.6
121-16-20G	16	80	90	DC24	35	1.46	16	B	3000	1.34×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	18.5
121-20-20G	20	160	175	DC24	45	1.88	13	B	2500	4.13×10^{-2}	10×10^8	C:0.090 B:0.065	C:0.250 B:0.200	C:0.130 B:0.070	35
121-25-20G	25	320	350	DC24	60	2.50	9.6	B	2000	1.02×10^{-1}	20×10^8	C:0.115 B:0.085	C:0.335 B:0.275	C:0.210 B:0.125	64

*The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions



Unit [mm]

Size	Dimensions of part																		Dimensions of shaft										
	A_1	A_2	B_1	B_2	C	D	E	F	G	H	J_1	J_2	K	L	M	N	Z_1	Z_2	Q_1	Q_2	S_1	S_2	U_1	U_2	V_1	V_2	X_1	X_2	$W_{1,2}$
06	52.5	75	80	90	55	80	27.5	53	2.6	95	65.5	40.5	105.5	181	47	33	13.5	6.5	25	20	11	38	12.5	39.5	M4 × 0.7, length: 8	3-M4 × 0.7, length: 4	3-120°	60°	4
08	65	90	90	105	65	100	27.5	61	2.6	115	78.5	48.5	126.5	217	57	37	13.5	6.5	30	25	14	45	16	47	M4 × 0.7, length: 8	3-M4 × 0.7, length: 6	3-120°	60°	5
10	80	110	110	130	80	125	32.5	72	3.2	142.5	98	62	154	270	72	47	15.5	9	40	30	19	55	21	57	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	5
12	105	135	140	160	90	150	35	81	3.2	165	121	73.5	184	330	92	52	20	11.5	50	40	24	64	27	67	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	7
16	135	160	175	185	112	190	43	97	4.5	207	149	90	221	399	113	62	24.5	11.5	60	50	28	75	31	78	M6 × 1, length: 11	6-M5 × 0.8, length: 8	6-60°	30°	7
20	155	200	200	230	132	230	45	109	6	247	187	117	276	504	142	74.5	28	14	80	60	38	90	41.5	93.5	M10 × 1.5, length: 17	4-M6 × 1, length: 12	4-90°	45°	10
25	195	240	240	270	160	290	47.5	124	20	305	238	154	334	632	183	101.5	28	14	110	70	42	115	45.5	118.5	M10 × 1.5, length: 17	8-M6 × 1, length: 12	8-45°	22.5°	12

* The input/output shaft keyways are old JIS standard class 2 while the key is old JIS standard class 1. Note that the keyway dimensions of the unit hub part do not conform to the old JIS standard. Check them on the dimensions table above.

* When inserting pulleys or the like onto input/output shafts, use the supplied insertion set.

* The 121-25-20G base is a casting.

How to Place an Order

121-06-20G

Size

List of Stand-alone Clutches and Brakes Used

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	
			Main shaft part	Hub part
121-06-20G	101-06-15G 24V R15JIS A12JIS	111-06-12G 24V 15JIS	6202	6001
121-08-20G	101-08-15G 24V R20JIS A15JIS	111-08-12G 24V 20JIS	6004	6002
121-10-20G	101-10-15G 24V R25JIS A20JIS	111-10-12G 24V 25JIS	6205	6004
121-12-20G	101-12-15G 24V R30JIS A25JIS	111-12-12G 24V 30JIS	6206	6005
121-16-20G	101-16-15G 24V R40JIS A30JIS	111-16-12G 24V 40JIS	6208	6006
121-20-20G	101-20-15G 24V R50JIS A40JIS	111-20-12G 24V 50JIS	6211	6008
121-25-20G	101-25-15G 24V R60JIS A50JIS	111-25-12G 24V 60JIS	6214	6010

Recommended Power Supplies and Accessory Parts

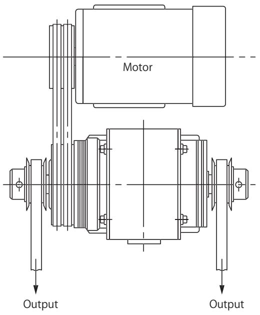
Model	Recommended power supplies	Accessory parts				
		Circuit protector (Varistor), qty. 2	Tightening collar	Screw stock	Presser foot	Hexagonal nut
121-06-20G	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-08-20G	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-10-20G	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-12-20G	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 2/M6 × 100, qty. 1	Qty. 1	M4, qty. 2/M6, qty. 1
121-16-20G	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M5 × 70, qty. 2/M6 × 100, qty. 1	Qty. 1	M5, qty. 2/M6, qty. 1
121-20-20G	BEH-20G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 160, qty. 2/M10 × 220, qty. 1	Qty. 1	M6, qty. 4/M10, qty. 2
121-25-20G	BEH-20G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 160, qty. 2/M10 × 220, qty. 1	Qty. 1	M6, qty. 4/M10, qty. 2

* NVD□SCD□ parts are manufactured by KOA Corporation.
* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

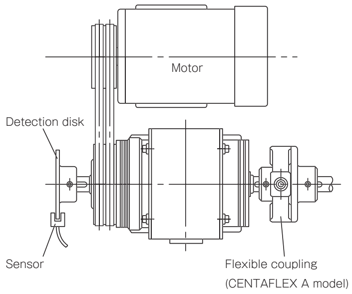
Mounting Example

This clutch/brake unit allows the output shaft to be used in two locations, so both outputs can be used simultaneously, or one can be connected to a load and a rotation detection disk mounted to the other. A variety of transmission paths can be used in layouts.

Example with Two Outputs



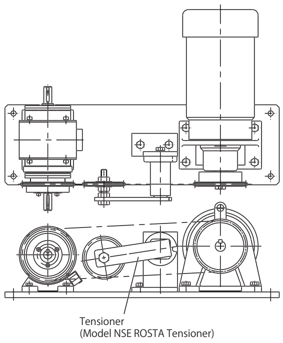
Example with Detection Disk on One Side



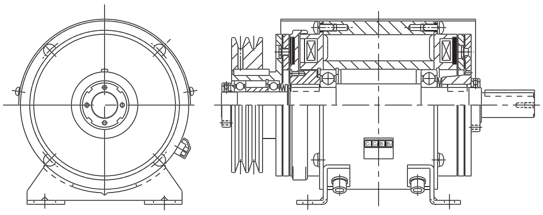
Special Types

In addition to the special application examples shown below, drivers can also be set, and units can be provided with pulleys, sprockets, and the like. Contact Miki Pulley for details.

One-piece Unit Connected by Geared Motor and Sprocket



Clutch/Brake Unit with V Pulley Mounted on Input Side



126 Models Clutch/Brake Units - Motor-coupled Type

Specifications (126-□-4B)

Model	Size	Motor output [kW] 4-poles	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
					Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]							
126-06-4B-0.2kW	06	0.2	5	5.5	DC24	11	0.46	52	B	1.28×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	8.9
126-08-4B-0.4kW	08	0.4	10	11	DC24	15	0.63	38	B	3.70×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	13
126-10-4B-0.75kW-IE3	10	0.75	20	22	DC24	20	0.83	29	B	1.40×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	20
126-12-4B-1.5kW-IE3	12	1.5	40	45	DC24	25	1.09	23	B	3.85×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	41
126-16-4B-2.2kW-IE3	16	2.2	80	90	DC24	35	1.46	16	B	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	54
126-16-4B-3.7kW-IE3	16	3.7	80	90	DC24	35	1.46	16	B	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	69

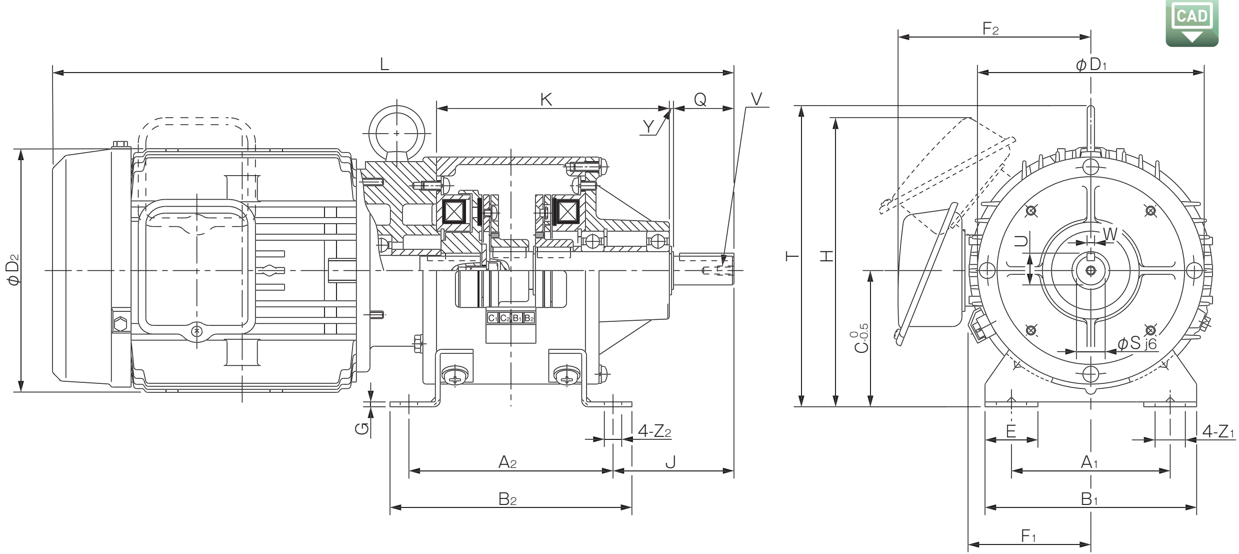
* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher).

* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.

* If you desire a special voltage (5 Power Supply Specifications), different number of poles, or the like for the induction motor, contact Miki Pulley.

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions (126-□-4B)



Unit [mm]

Model	Dimensions of part																		Dimensions of shaft				
	A_1	A_2	B_1	B_2	C	D_1	D_2	E	F_1	F_2	G	J	K	L	H	T	Y	Z_1	Z_2	Q	S	U	V	W
126-06-4B-0.2kW	65	90	90	105	65	100	130	27.5	61	—	2.6	48.5	102	335	—	—	3	13.5	6.5	25	11	12.5	M4 × 0.7, length: 8	4
126-08-4B-0.4kW	80	110	110	130	80	125	145	32.5	72	126.5	3.2	63	127.5	389	167.5	—	2.5	15.5	9	30	14	16	M4 × 0.7, length: 8	5
126-10-4B-0.75kW-IE3	105	135	140	160	90	150	163	35	81	136	3.2	80	154	462	184	—	3	20	11.5	40	19	21	M6 × 1, length: 11	5
126-12-4B-1.5kW-IE3	135	160	175	185	112	190	182/176	42.5	97	148.5	15	108	194	550.5	—	244.5	3	24.5	11.5	50	24	27	M6 × 1, length: 11	7
126-16-4B-2.2kW-IE3	155	200	200	230	132	230	198/195	45	109	155.5	18	135	256	649.5	—	286	4	28	14	50	24	27	M6 × 1, length: 11	7
126-16-4B-3.7kW-IE3	155	200	200	230	132	230	225/215	45	109	168.5	18	145	256	681	—	295	4	28	14	60	28	31	M6 × 1, length: 11	7

* The output shaft keyways are old JIS standard class 2 while the key is old JIS standard class 1.

* When inserting pulleys or the like onto output shafts, use the supplied insertion set.

* These models are cast basded on a motor output of 1.5 kW or greater.

How to Place an Order

126-06-4B-0.2kW-IE3

Size

Mounting type
B: Base-mounted

Motor output

IE code
For motors with an output of 0.75 kW or greater,
use the IE3 designation.

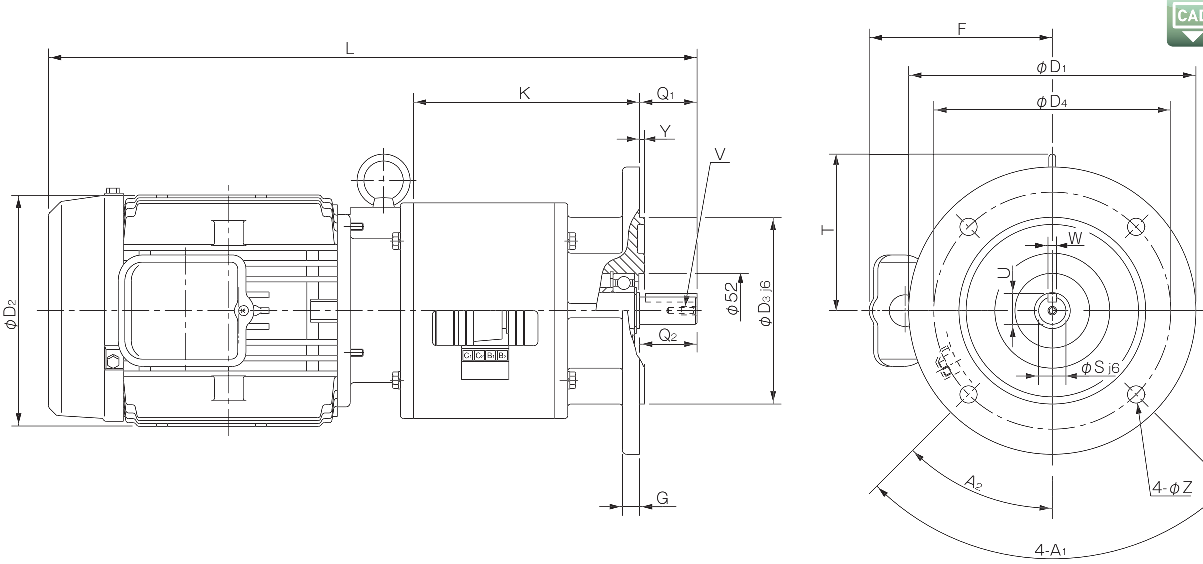
Specifications (126- □ -4F-N)

Model	Size	Motor output [kW] 4-poles	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
					Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]							
126-06-4F-N-0.2kW	06	0.2	5	5.5	DC24	11	0.46	52	B	1.28×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	8.9
126-08-4F-N-0.4kW	08	0.4	10	11	DC24	15	0.63	38	B	3.70×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	13
126-10-4F-N-0.75kW-IE3	10	0.75	20	22	DC24	20	0.83	29	B	1.40×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	20
126-12-4F-N-1.5kW-IE3	12	1.5	40	45	DC24	25	1.09	23	B	3.85×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	41
126-16-4F-N-2.2kW-IE3	16	2.2	80	90	DC24	35	1.46	16	B	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	54
126-16-4F-N-3.7kW-IE3	16	3.7	80	90	DC24	35	1.46	16	B	1.35×10^{-2}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	69

* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher).
* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.
* If you desire a special voltage (5 Power Supply Specifications), different number of poles, or the like for the induction motor, contact Miki Pulley.
* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.

Dimensions (126- □ -4F-N)

CAD



Unit [mm]

Model	Dimensions of part													Dimensions of shaft					
	A_1	A_2	D_1	D_2	D_3	D_4	F	G	K	L	T	Y	Z	Q_1	Q_2	S	U	V	W
126-06-4F-N-0.2kW	90°	45°	160	130	110	130	—	8	107	335	—	3.5	10	23	25	11	12.5	M4 × 0.7, length: 8	4
126-08-4F-N-0.4kW	90°	45°	160	145	110	130	124	10	130.5	389	—	3.5	10	30	30	14	16	M4 × 0.7, length: 8	5
126-10-4F-N-0.75kW-IE3	90°	45°	200	163	130	165	131	12	157.5	463	—	3.5	12	40	40	19	21.5	M6 × 1, length: 11	6
126-12-4F-N-1.5kW-IE3	90°	45°	200	182/176	130	165	148.5	12	197.5	551	133	3.5	12	50	50	24	27	M6 × 1, length: 11	8
126-16-4F-N-2.2kW-IE3	90°	45°	250	198/195	180	215	155.5	16	260.5	660	154	4	15	60	60	28	31	M6 × 1, length: 11	8
126-16-4F-N-3.7kW-IE3	90°	45°	250	225/215	180	215	168.5	16	260.5	681.5	163	4	15	60	60	28	31	M6 × 1, length: 11	8

* The flange and output shaft dimensions conform to IEC and JEM standard flange motors. (Size 06 has a key and a keyway.)
* When inserting pulleys or the like onto output shafts, use the supplied insertion set.

How to Place an Order

126-06-4F-N-0.2kW-IE3

Size
Mounting type
F: Flange-mount
Flange and output shaft dimension standards
N: Compliant with IEC and JEM flange motor standards
Motor output
IE code
For motors with an output of 0.75 kW or greater, use the IE3 designation.

126 Models

List of Stand-alone Clutches and Brakes Used

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	
			Input part	Output part
126-06-4☐-0.2kW	101-06-11G 24V R11JIS A15JIS	111-06-12G 24V 15JIS	6202	6202
126-08-4☐-0.4kW	101-08-11G 24V R14DIN A20JIS	111-08-12G 24V 20JIS	6203	6004
126-10-4☐-0.75kW-IE3	101-10-11G 24V R19DIN A25JIS	111-10-12G 24V 25JIS	6204	6205
126-12-4☐-1.5kW-IE3	101-12-11G 24V R24DIN A30JIS	111-12-12G 24V 30JIS	6205	6206
126-16-4☐-2.2kW-IE3	101-16-11G 24V R28DIN A40JIS	111-16-12G 24V 40JIS	6206	6208
126-16-4☐-3.7kW-IE3	101-16-11G 24V R28DIN A40JIS	111-16-12G 24V 40JIS	6306	6208

Recommended Power Supplies and Accessory Parts

Model	Recommended power supplies	Accessory parts			
		Circuit protector (Varistor), qty. 2	Tightening collar	Screw stock	Hexagonal nut
126-06-4☐-0.2kW	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55 (hex-socket bolt), qty. 1	M4, qty. 1
126-08-4☐-0.4kW	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55 (hex-socket bolt), qty. 1	M4, qty. 1
126-10-4☐-0.75kW-IE3	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
126-12-4☐-1.5kW-IE3	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
126-16-4☐-2.2kW-IE3	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2
126-16-4☐-3.7kW-IE3	BEH-10G	NVD07SCD082 or an equivalent	Qty. 1	M6 × 100, qty. 1	M6, qty. 2

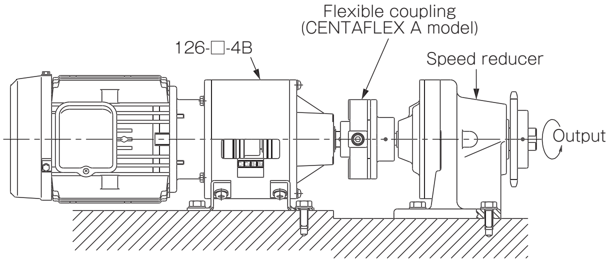
* NVD☐SCD☐ parts are manufactured by KOA Corporation.

* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

Mounting Example

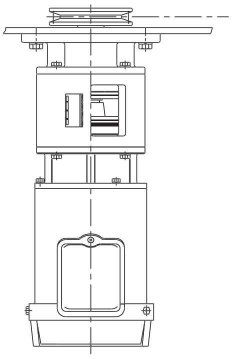
In Combination with Speed Reducers

In the example on right, a clutch/brake unit of the motorcoupled type is combined with a speed reducer by a flexible coupling.
Since the motor is directly coupled, the build-up of the rotation shaft is sharp. That makes it desirable in design to keep inertia on the load side as small as possible. We recommend a flexible coupling with low inertia for connecting to the speed reducer.



Example Using Flange-mounted Type Vertically

They can be mounted in any direction, providing layout freedom and saving space.



CBW Models Clutch/Brake Units - Speed Reducer-integrated Type

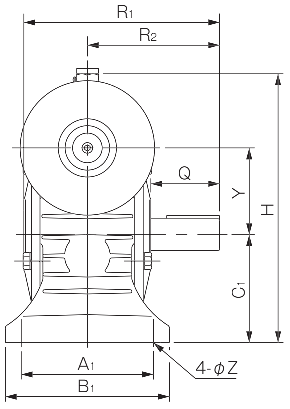
Specifications (CBW-□N-H□)

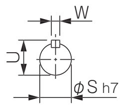
Model	Size	Dynamic friction Torque T_d [N·m]	Static friction Torque T_s [N·m]	Coil (at 20℃) Voltage [V]	Coil (at 20℃) Wattage [W]	Coil (at 20℃) Current [A]	Coil (at 20℃) Resistance [Ω]	Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Total work performed readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]
CBW-06N-H□	06	5	5.5	DC24	11	0.46	52	B	1800	1.66×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015
CBW-08N-H□	08	10	11	DC24	15	0.63	38	B	1800	4.78×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025
CBW-10N-H□	10	20	22	DC24	20	0.83	29	B	1800	1.71×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030
CBW-12N-H□	12	40	45	DC24	25	1.09	23	B	1800	4.53×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050

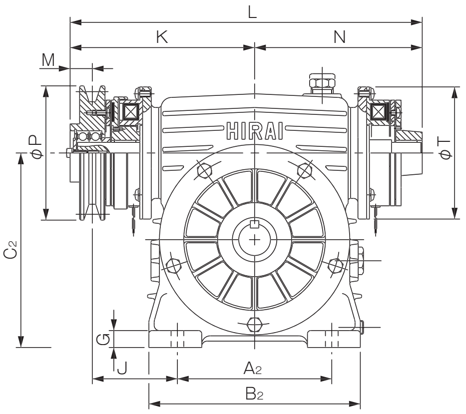
* The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Model	Size	Input part		Speed reducer									Mass [kg]
		Pulley diameter [mm]	Belt type	Model	Output shaft rated values	Speed reduction ratio 1/□						Oil volume [ℓ]	
						10	20	30	40	50	60		
CBW-06N-H□	06	76.2 (3 in.)	A-1	N-1A	Torque [N·m]	45.3	53.4	46.7	54.7	54.2	55.4	0.25	6.5
					O.H.L. [N]	1560	1760	1760	1760	1760	1760		
CBW-08N-H□	08	101.6 (4 in.)	A-1	N-2A	Torque [N·m]	79.8	102	86.9	104	98.5	100	0.5	15
					O.H.L. [N]	1760	2240	2630	2880	3140	3230		
CBW-10N-H□	10	127 (5 in.)	B-1	N-3A	Torque [N·m]	165	180	180	188	187	164	1.0	24
					O.H.L. [N]	2250	2900	3370	3720	4040	4370		
CBW-12N-H□	12	152.4 (6 in.)	B-1	N-4A	Torque [N·m]	292	293	301	302	—	—	2.0	38
					O.H.L. [N]	2780	3640	4210	4680	—	—		

Dimensions (CBW-□N-H□)







Unit [mm]

Model	Dimensions of part																			Dimensions of shaft			
	A_1	A_2	B_1	B_2	C_1	C_2	G	H	J	K	L	M	N	P	R_1	R_2	T	Y	Z	Q	S	U	W
CBW-06N-H□	95	95	117	136	65	115.8	11	157	58	120.5	225	15	104.5	76.2	135	90	80	50.8	9.5	45	20	22.5	6
CBW-08N-H□	115	112	140	165	82	146	15	212	75	149	284	18	135	101.6	160	105	100	64	11	50	25	28	8
CBW-10N-H□	125	146	155	205	102	184	16	255	80.5	174.5	333	21	158.5	127	185	125	125	82	12	65	30	33	8
CBW-12N-H□	150	168	185	245	118	213	20	289	93	203	388	25.5	185	152.4	225	150	150	95	14	75	35	38	10

How to Place an Order

CBW-06N-HR-10

Size

Speed reducer manufacturer
HIRAI REDUCTION GEAR MFG. CO.: H

Speed reduction ratio 1/□: 10, 20, 30, 40, 50, 60
(Size 12: 10, 20, 30, 40)

Output shaft direction
R: Right side of the output shaft as viewed from the input pulley
L: Left side of the output shaft as viewed from the input pulley

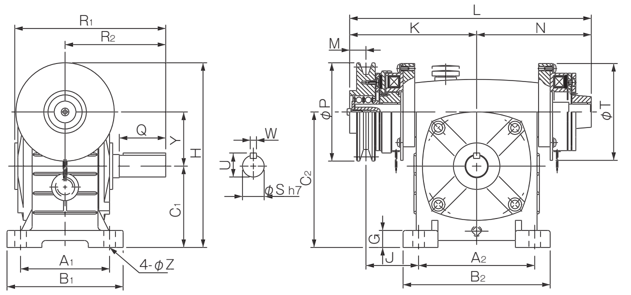
Specifications (CBW-□N-B□)

Model	Size	Dynamic friction torque Td [N·m]	Static friction torque Ts [N·m]	Coil (at 20℃) Voltage [V]	Coil (at 20℃) Wattage [W]	Coil (at 20℃) Current [A]	Coil (at 20℃) Resistance [Ω]	Heat resistance class	Max. rotation speed [mim -1]	Rotating part Moment of inertia J [kg·m²]	Total work until readjustment of the air gap ET [J]	Armature pull-in time ta [s]	Torque build-up time tp [s]	Torque decaying time td [s]
CBW-06N-B□-10～30	06	5	5.5	DC24	11	0.46	52	B	1800	1.56×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015
CBW-06N-B□-40～60										1.76×10^{-4}				
CBW-08N-B□-10～30	08	10	11	DC24	15	0.63	38	B	1800	4.70×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025
CBW-08N-B□-40～60										4.85×10^{-4}				
CBW-10N-B□-10～30	10	20	22	DC24	20	0.83	29	B	1800	1.48×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030
CBW-10N-B□-40～60										1.61×10^{-3}				
CBW-12N-B□-10～30	12	40	45	DC24	25	1.09	23	B	1800	4.23×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050
CBW-12N-B□-40～60										4.35×10^{-3}				

*The dynamic friction torque, Td, is measured at a relative speed of 100 min-1.

Model	Size	Input part		Speed reducer										Mass [kg]
		Pulley diameter [mm]	Belt Model	Model	Output shaft rated values	Speed reduction ratio 1/□						Oil volume [ℓ]	
						10	20	30	40	50	60		
CBW-06N-B□-10～30	06	76.2 (3 in.)	A-1	N-PR-12	Torque [N·m]	35	38	44	—	—	—	0.3	9
					O.H.L. [N]	950	1313	1548	—	—	—		
CBW-06N-B□-40～60				N-PR-15	Torque [N·m]	—	—	—	64	56	56	0.4	11
					O.H.L. [N]	—	—	—	2450	2450	2450		
CBW-08N-B□-10～30	08	101.6 (4 in.)	A-1	N-PR-15	Torque [N·m]	56	57	72	—	—	—	0.4	11.5
					O.H.L. [N]	1421	1862	2322	—	—	—		
CBW-08N-B□-40～60				N-PR-18	Torque [N·m]	—	—	—	143	136	138	0.7	16.5
					O.H.L. [N]	—	—	—	2646	2646	2646		
CBW-10N-B□-10～30	10	127 (5 in.)	B-1	N-PR-18	Torque [N·m]	120	126	150	—	—	—	0.7	17.5
					O.H.L. [N]	1490	2077	2440	—	—	—		
CBW-10N-B□-40～60				N-PR-22	Torque [N·m]	—	—	—	191	187	167	1.2	23.5
					O.H.L. [N]	—	—	—	3057	3146	3155		
CBW-12N-B□-10～30	12	152.4 (6 in.)	B-1	N-PR-22	Torque [N·m]	166	167	213	—	—	—	1.2	25
					O.H.L. [N]	1715	2528	2871	—	—	—		
CBW-12N-B□-40～60				N-PR-25	Torque [N·m]	—	—	—	373	352	336	2.9	40
					O.H.L. [N]	—	—	—	3665	3783	4126		

Dimensions (CBW-□N-B□)



CAD

Unit [mm]

Model	Dimensions of part																			Dimensions of shaft			
	A1	A2	B1	B2	C1	C2	G	H	J	K	L	M	N	P	R1	R2	T	Y	Z	Q	S	U	W
CBW-06N-B□-10～30	95	110	130	140	80	130	15	175	56	126	236	15	110	76.2	145	95	80	50	11	40	17	19	5
CBW-06N-B□-40～60	105	120	130	150	90	150	20	200	56	131	246	15	115	76.2	165	110	80	60	11	50	22	24.5	6
CBW-08N-B□-10～30	105	120	130	150	90	150	20	201	59	137	260	18	123	101.6	165	110	100	60	11	50	22	24.5	6
CBW-08N-B□-40～60	115	150	150	190	105	175	25	230	61	154	294	18	140	101.6	195	130	100	70	15	60	28	31	8
CBW-10N-B□-10～30	115	150	150	190	105	175	25	238.5	68	164	312	21	148	127	195	130	125	70	15	60	28	31	8
CBW-10N-B□-40～60	135	180	170	220	120	200	25	265	63	174	332	21	158	127	210	140	125	80	15	65	32	35	10
CBW-12N-B□-10～30	135	180	170	220	120	200	25	276	67.5	179	345	21	166	152.4	210	140	150	80	15	65	32	35	10
CBW-12N-B□-40～60	155	220	190	270	150	250	25	370	76.5	210	405	23.5	195	152.4	260	170	150	100	15	75	38	41	10

How to Place an Order

CBW-06N-BR-10

Size

Speed reducer manufacturer
Bellpony Co., Ltd.: B

Speed reduction ratio 1/□: 10, 20, 30, 40, 50, 60

Output shaft direction
R: Right side of the output shaft as viewed from the input pulley
L: Left side of the output shaft as viewed from the input pulley

CBW Models

List of Stand-alone Clutches and Brakes Used and Recommended Power Supplies and Accessory Parts (CBW-□N-H□)

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	Recommended power supplies	Accessory parts
					Circuit protector (Varistor), qty. 2
CBW-06N-H□	101-06-13-A-110	111-06-11G 24V 15JIS	6002	BEH-10G	NVD07SCD082 or an equivalent
CBW-08N-H□	101-08-13-A-102	111-08-11G 24V 17JIS	6003	BEH-10G	NVD07SCD082 or an equivalent
CBW-10N-H□	101-10-13-A-113	111-10-11G 24V 20JIS	6004	BEH-10G	NVD07SCD082 or an equivalent
CBW-12N-H□	101-12-13-A-134	111-12-11G 24V 25JIS	6005	BEH-10G	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

List of Stand-alone Clutches and Brakes Used and Recommended Power Supplies and Accessory Parts (CBW-□N-B□)

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	Recommended power supplies	Accessory parts
					Circuit protector (Varistor), qty. 2
CBW-06N-B□-10 ～ 30	101-06-13-A-110	111-06-11G 24V 15JIS	6002	BEH-10G	NVD07SCD082 or an equivalent
CBW-06N-B□-40 ～ 60	101-06-13-A-110	111-06-11G 24V 15JIS	6002	BEH-10G	NVD07SCD082 or an equivalent
CBW-08N-B□-10 ～ 30	101-08-13-A-102	111-08-11G 24V 17JIS	6003	BEH-10G	NVD07SCD082 or an equivalent
CBW-08N-B□-40 ～ 60	101-08-13-A-102	111-08-11G 24V 17JIS	6003	BEH-10G	NVD07SCD082 or an equivalent
CBW-10N-B□-10 ～ 30	101-10-13-A-113	111-10-11G 24V 20JIS	6004	BEH-10G	NVD07SCD082 or an equivalent
CBW-10N-B□-40 ～ 60	101-10-13-A-114	111-10-11G 24V 25JIS	6005	BEH-10G	NVD07SCD082 or an equivalent
CBW-12N-B□-10 ～ 30	101-12-13-A-134	111-12-11G 24V 25JIS	6005	BEH-10G	NVD07SCD082 or an equivalent
CBW-12N-B□-40 ～ 60	101-12-13-A-135	111-12-11G 24V 30JIS	6006	BEH-10G	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

Selecting a CBW Worm Reducer

For speed reducers with clutches/brakes, loads start and stop abruptly, so load inertia and the like place large loads on worm wheels. Select a worm reducer based on frequency of use, load inertia, usage time, and the like, with due consideration to safety rates.

- Determining speed reduction ratio I

$$\text{Speed reduction ratio I} = \frac{\text{Speed of output shaft rotation } N_2\ [\text{min}^{-1}]}{\text{Speed of input shaft rotation } N_1\ [\text{min}^{-1}]}$$

- Calculating equivalent torque

$$\text{Equivalent torque Te [N•m]} = \text{Load torque Tf [N•m]} \times \text{Load coefficient Sf} \times \text{Frequency coefficient Sh}$$

$$\text{Load torque Tf [N•m]} = \frac{9550 \times \text{kW} \times \text{E}}{N_2}$$

kW: Input Wattage [kW]

E: Speed reducer efficiency [%]/100

* See the speed reducer manufacturer's catalog for the speed reducer efficiency.

N2: Output rotation speed [min^{-1}]

- Load coefficient Sf and frequency coefficient Sh
  Find the equivalent value for conditions such as load type, time, and frequency of use.

Load coefficient Sf

Load type Continuous time	Uniform load	Normal shock	Sharp shock
Up to 2 hrs.	0.80	1.00	1.25
Up to 8 hrs.	1.00	1.25	1.50
Up to 24 hrs.	1.25	1.50	1.75

Frequency coefficient Sh

For sharp starts and stops due to clutch/brake	1.5

- Provisional selection of speed reducer
  Select a speed reducer from the specifications table for which equivalent torque Te ≦ rated output torque T.

- Calculating the equivalent overhang load (O.H.L.)
  O.H.L. refers to the load that acts to bend the shaft when transmitting power using a chain or the like.

$$\text{Equivalent O.H.L.} = \frac{\text{Te} \times \text{K} \times (\text{L}+0.57 \times \text{Ls})}{\text{R} \times 1.07 \times \text{Ls}}$$

Te: Equivalent torque [N•m]

K: Factor based on type of transmission tool

R: Pitch radius of transmission tool [m]

Ls: Length of standard shaft [mm]

L: Distance from shaft base to load center [mm]

Transmission tool	Chain timing belt	Gear	V belt	Flat belt
K	1.00	1.25	1.50	2.50

Use the specifications to confirm that equivalent O.H.L ≦ rated O.H.L. If this condition is not satisfied, change Te, L or R, or increase the selected output.

Operational Cautions

- Before starting, check that the speed reducer has a good amount of oil.
- Loosen or remove the air vent screw or pin.
- Break in the reducer, guided by the manual from the speed reducer manufacturer.
- Periodically replace the oil. Be careful when doing this to not get any oil whatsoever on the clutch and brake parts.

Recommended speed reducer lubricants table

Ambient temperature [℃]	0 ～ 40
ISO viscosity grade	VG320
Idemitsu Kosan	Daphne Super Gear Oil 320
JX Nippon Oil & Energy	Bonnock 320
Cosmo Oil	Cosmo Gear SE320
Showa Shell Sekiyu	Omara 320
Jomo Oil	Reductus 320
Mobil Oil	Mobilgear 632 (320)

* Check the volume of oil for speed reducers on the specifications table.

CMW Models Clutch/Brake Units - Motor/Speed Reducer-integrated Type

Specifications

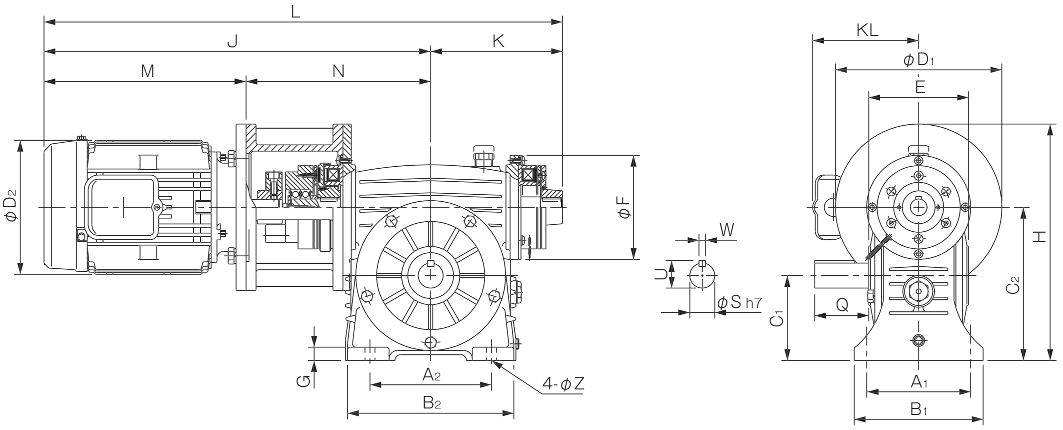
Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]						
CMW-06N-H□H	06	5	5.5	DC24	11	0.46	52	B	1.66×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015
CMW-08N-H□H	08	10	11	DC24	15	0.63	38	B	4.78×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025
CMW-10N-H□H	10	20	22	DC24	20	0.83	29	B	1.71×10^{-3}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030
CMW-12N-H□H	12	40	45	DC24	25	1.09	23	B	4.53×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.

Model	Size	Motor output [kW] 3-phase 4-pole	Speed reducer									Mass [kg]
			Model	Output shaft rated values	Speed reduction ratio 1/□						Oil volume [ℓ]	
					10	20	30	40	50	60		
CMW-06N-H□H	06	0.2	N-2SA	Torque [N·m]	78.2	79.9	85.3	78.6	88.9	76.1	0.5	16
				O.H.L. [N]	1770	2280	2620	2930	3160	3230		
CMW-08N-H□H	08	0.4	N-2A	Torque [N·m]	79.8	102	86.9	104	98.5	100	0.5	32
				O.H.L. [N]	1760	2240	2630	2880	3140	3230		
CMW-10N-H□H	10	0.75	N-3A	Torque [N·m]	165	180	180	188	187	164	1.0	44
				O.H.L. [N]	2250	2900	3370	3720	4040	4370		
CMW-12N-H□H	12	1.5	N-4A	Torque [N·m]	292	293	301	302	–	–	2.0	72
				O.H.L. [N]	2780	3640	4210	4680	–	–		

* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher).
* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.
* If you desire a special voltage (5 Power Supply Specifications), different number of poles, or the like for the induction motor, contact Miki Pulley.
* Speed reducer is made by Hirai Reduction Gear Manufacturing Co.

Dimensions



Unit [mm]

Model	Dimensions of part																			Dimensions of shaft			
	A_1	A_2	B_1	B_2	C_1	C_2	D_1	D_2	E	F	G	H	J	K	KL	L	M	N	Z	Q	S	U	W
CMW-06N-H□H	105	105	132	157	75	135	160	130	110	86	15	215	375	117	–	492	205	170	12	50	25	28	8
CMW-08N-H□H	115	112	140	165	82	146	160	145	110	100	15	226	412	135	124	547	225	187	11	50	25	28	8
CMW-10N-H□H	125	146	155	200	102	184	200	163	120	125	16	284	465	159	131	636	243	222	12	65	30	33	8
CMW-12N-H□H	150	168	186	245	118	213	210	182/176	150	150	20	318	529	185	148.5	726	274	255	14	75	35	38	10

How to Place an Order

CMW-06N-HRH-10-IE3

Size

IE code
For motors with an output of 0.75 kW or greater, use the IE3 designation.

Speed reduction ratio 1/□: 10, 20, 30, 40, 50, 60
(Size 12: 10, 20, 30, 40)

Output shaft direction
R: Right side of the output shaft as viewed from the motor side
L: Left side of the output shaft as viewed from the motor side

List of Stand-alone Clutches and Brakes Used and Recommended Power Supplies and Accessory Parts (CBW-□N-H□)

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	Coupling type	Recommended power supplies	Accessory parts
						Circuit protector (Varistor), qty. 2
CMW-06N-H□H	101-06-13G 24V 15JIS	111-06-11G 24V 15JIS	6002	CF-A-001-01-T5	BEH-10G	NVD07SCD082 or an equivalent
CMW-08N-H□H	101-08-13G 24V 17JIS	111-08-11G 24V 17JIS	6003	CF-A-002-01-1360-14N	BEH-10G	NVD07SCD082 or an equivalent
CMW-10N-H□H	101-10-13G 24V 20JIS	111-10-11G 24V 20JIS	6004	CF-A-002-01-1360-19N	BEH-10G	NVD07SCD082 or an equivalent
CMW-12N-H□H	101-12-13G 24V 25JIS	111-12-11G 24V 25JIS	6005	CF-A-004-01-1360-24N	BEH-10G	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* Varistors need not be used when a BEH model overexcitation electromagnetic power supply is used. For details, refer to the section on power supplies.

Selecting a CMW Worm Reducer

For speed reducers with clutches/brakes, loads start and stop abruptly, so load inertia and the like place large loads on worm wheels. Select a worm reducer based on frequency of use, load inertia, usage time, and the like, with due consideration to safety rates.

- Determining speed reduction ratio I

$$\text{Speed reduction ratio I} = \frac{\text{Speed of output shaft rotation } N_2\ [\min^{-1}]}{\text{Speed of input shaft rotation } N_1\ [\min^{-1}]}$$

- Calculating equivalent torque

$$\text{Equivalent torque Te [N•m]} = \text{Load torque Tf [N•m]} \times \text{Load coefficient Sf} \times \text{Frequency coefficient Sh}$$

$$\text{Load torque Tf [N•m]} = \frac{9550 \times kW \times E}{N_2}$$

kW: Input Wattage [kW]
E: Speed reducer efficiency [%]/100
* See the speed reducer manufacturer's catalog for the speed reducer efficiency.
N_2: Output rotation speed [min^{-1}]

- Load coefficient Sf and frequency coefficient Sh
  Find the equivalent value for conditions such as load type, time, and frequency of use.

■ Load coefficient Sf

Load type Continuous time	Uniform load	Normal shock	Sharp shock
Up to 2 hrs.	0.80	1.00	1.25
Up to 8 hrs.	1.00	1.25	1.50
Up to 24 hrs.	1.25	1.50	1.75

■ Frequency coefficient Sh

For sharp starts and stops due to clutch/brake	1.5

- Provisional selection of speed reducer
  Select a speed reducer from the specifications table for which equivalent torque Te ≦ rated output torque T.

- Calculating the equivalent overhang load (O.H.L.)
  O.H.L. refers to the load that acts to bend the shaft when transmitting power using a chain or the like.

$$\text{Equivalent O.H.L.} = \frac{Te \times K \times (L + 0.57 \times Ls)}{R \times 1.07 \times Ls}$$

Te: Equivalent torque [N•m]
K: Factor based on type of transmission tool
R: Pitch radius of transmission tool [m]
Ls: Length of standard shaft [mm]
L: Distance from shaft base to load center [mm]

Transmission tool	Chain timing belt	Gear	V belt	Flat belt
K	1.00	1.25	1.50	2.50

Use the specifications to confirm that equivalent O.H.L ≦ rated O.H.L. If this condition is not satisfied, change Te, L or R, or increase the selected output.

Operational Cautions

- Before starting, check that the speed reducer has a good amount of oil.
- Loosen or remove the air vent screw or pin.
- Break in the reducer, guided by the manual from the speed reducer manufacturer.
- Periodically replace the oil. Be careful when doing this to not get any oil whatsoever on the clutch and brake parts.

■ Recommended speed reducer lubricants table

Ambient temperature [℃]	0 ～ 40
ISO viscosity grade	VG320
Idemitsu Kosan	Daphne Super Gear Oil 320
JX Nippon Oil & Energy	Bonnock 320
Cosmo Oil	Cosmo Gear SE320
Showa Shell Sekiyu	Omara 320
Jomo Oil	Reductus 320
Mobil Oil	Mobilgear 632 (320)

■ List of speed reducer oil volumes

Speed reducer type	Oil volume [ℓ]
N-2SA	0.5
N-2A	0.5
N-3A	1.0
N-4A	2.0

121-☐-10G Types Double Clutch Units

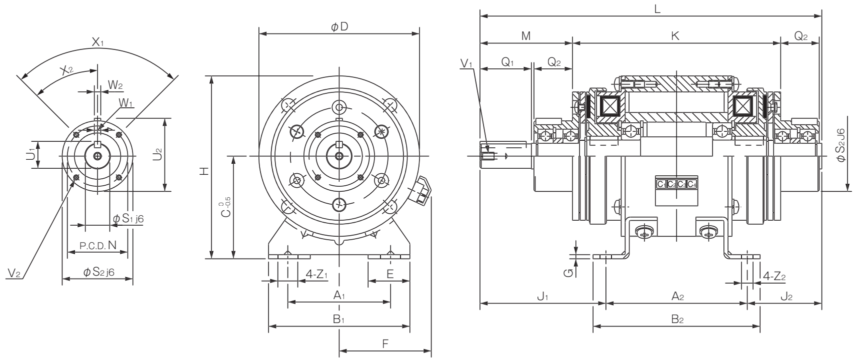
Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m²]		Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]			For hub input	For shaft input					
121-06-10G	06	5	5.5	DC24	11	0.46	52	B	3000	1.55×10^{-4}	1.05×10^{-4}	36×10^6	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	1.7
121-08-10G	08	10	11	DC24	15	0.63	38	B	3000	4.75×10^{-4}	3.00×10^{-4}	60×10^6	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	3.1
121-10-10G	10	20	22	DC24	20	0.83	29	B	3000	1.44×10^{-3}	9.45×10^{-4}	130×10^6	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	6.5
121-12-10G	12	40	45	DC24	25	1.09	23	B	3000	4.50×10^{-3}	2.75×10^{-3}	250×10^6	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	10.5
121-16-10G	16	80	90	DC24	35	1.46	16	B	3000	1.34×10^{-2}	9.05×10^{-3}	470×10^6	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	21
121-20-10G	20	160	175	DC24	45	1.88	13	B	2500	4.18×10^{-2}	2.65×10^{-2}	10×10^8	C:0.090 B:0.065	C:0.250 B:0.200	C:0.130 B:0.070	38.5
121-25-10G	25	320	350	DC24	60	2.50	9.6	B	2000	9.80×10^{-2}	7.45×10^{-2}	20×10^8	C:0.115 B:0.085	C:0.335 B:0.275	C:0.210 B:0.125	70

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min^{-1}.

* The rotating part moment of inertia for shaft input is the value with one armature type-5.

Dimensions



Unit [mm]

Size	Dimensions of part																	
	A_1	A_2	B_1	B_2	C	D	E	F	G	H	J_1	J_2	K	L	M	N	Z_1	Z_2
06	52.5	75	80	90	55	80	27.5	53	2.6	95	65.5	40.5	111.5	181	47	33	13.5	6.5
08	65	90	90	105	65	100	27.5	61	2.6	115	78.5	48.5	133	217	57	37	13.5	6.5
10	80	110	110	130	80	125	32.5	72	3.2	142.5	98	58	162	266	72	47	15.5	9
12	105	135	140	160	90	150	35	81	3.2	165	121	71	193	327	92	52	20	11.5
16	135	160	175	185	112	190	42.5	97	4.5	207	149	87.5	232	397	113	62	24.5	11.5
20	155	200	200	230	132	230	45	109	6	247	187	105	290	492	142	74.5	28	14
25	195	240	240	270	160	290	47.5	124	20	305	238	125	350	603	183	101.5	28	14

Size	Dimensions of shaft									
	Q_1	Q_2	S_1	S_2	U_1	U_2	V_1	V_2	X_1	X_2	$W_{1,2}$
06	25	20	11	38	12.5	39.5	M4 × 0.7, length: 8	3-M4 × 0.7, length: 4	3-120°	60°	4
08	30	25	14	45	16	47	M4 × 0.7, length: 8	3-M4 × 0.7, length: 6	3-120°	60°	5
10	40	30	19	55	21	57	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	5
12	50	40	24	64	27	67	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	7
16	60	50	28	75	31	78	M6 × 1, length: 11	6-M5 × 0.8, length: 8	6-60°	30°	7
20	80	60	38	90	41.5	93.5	M10 × 1.5, length: 17	4-M6 × 1, length: 12	4-90°	45°	10
25	110	70	42	115	45.5	118.5	M10 × 1.5, length: 17	8-M6 × 1, length: 12	8-45°	22.5°	12

* The input/output keyways are old JIS standard class 2 while the key is old JIS standard class 1. Note that the keyway dimensions of the unit hub part do not conform to the old JIS standard. Check them on the dimensions table above.

* When inserting pulleys or the like onto input/output shafts, use the supplied insertion set.

* The 121-25-10G base is a casting.

How to Place an Order

121-06-10G

Size

List of Stand-alone Clutches Used

Model	Stand-alone clutch system	Bearing number	
		Main shaft part	Hub part
121-06-10G	101-06-15G 24V R15JIS A12JIS	6202	6001
121-08-10G	101-08-15G 24V R20JIS A15JIS	6004	6002
121-10-10G	101-10-15G 24V R25JIS A20JIS	6205	6004
121-12-10G	101-12-15G 24V R30JIS A25JIS	6206	6005
121-16-10G	101-16-15G 24V R40JIS A30JIS	6208	6006
121-20-10G	101-20-15G 24V R50JIS A40JIS	6211	6008
121-25-10G	101-25-15G 24V R60JIS A50JIS	6214	6010

Recommended Power Supplies and Accessory Parts

Model	Recommended power supplies	Accessory parts				
		Circuit protector (Varistor), qty. 2	Tightening collar	Screw stock	Presser foot	Hexagonal nut
121-06-10G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-08-10G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-10-10G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
121-12-10G	BES-20-16	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 2/M6 × 100, qty. 1	Qty. 1	M4, qty. 2/M6, qty. 1
121-16-10G	BES-20-16	NVD07SCD082 or an equivalent	Qty. 1	M5 × 70, qty. 2/M6 × 100, qty. 1	Qty. 1	M5, qty. 2/M6, qty. 1
121-20-10G	BES-20-20	NVD07SCD082 or an equivalent	Qty. 1	M6 × 160, qty. 2/M10 × 220, qty. 1	Qty. 1	M6, qty. 4/M10, qty. 2
121-25-10G	BES-40-25	NVD07SCD082 or an equivalent	Qty. 1	M6 × 160, qty. 2/M10 × 220, qty. 1	Qty. 1	M6, qty. 4/M10, qty. 2

* NVD□SCD□ parts are manufactured by KOA Corporation.
* Recommended BES model power supplies are required for each clutch. Varistors need not be used when a BES model is used. For details, refer to the section on power supplies.

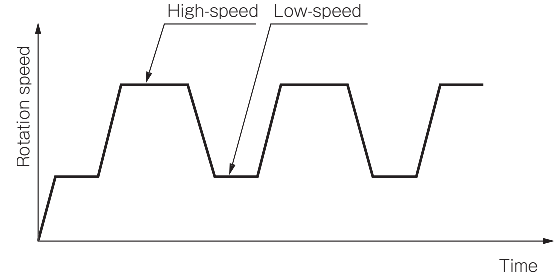
Mounting Example

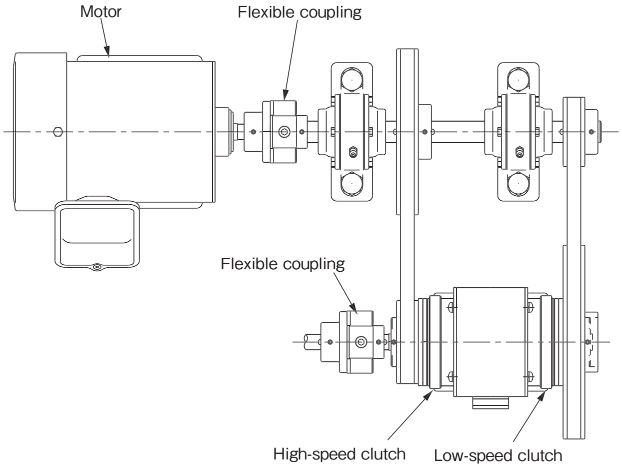
Example When Used in Two-step Speed Change

In two-step speed changing, two hubs are linked respectively to high-speed and low-speed power; by switching the clutches, the output shaft is made to rotate at high speed or low speed.

Caution

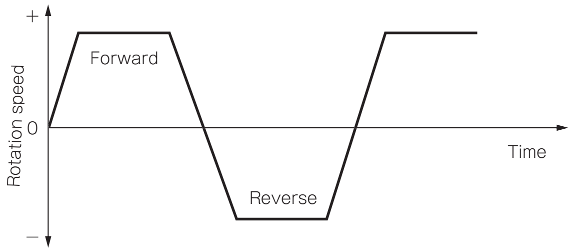
Conversely, when using the shaft as the input, one of the clutches is made to rotate at very high speed at some speed change ratios, so the bearings and the like may be damaged.

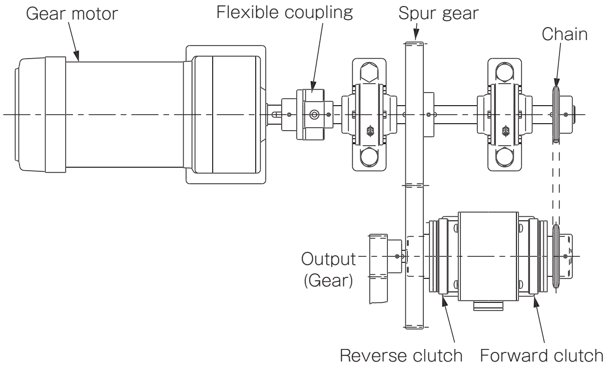




Example When Used in Forward/Reverse Operation

This unit does not have a brake, so forward/reverse operation is effective at relatively low speeds and light loads. In the example depicted, forward/reverse rotation is obtained from the drive-side rotation shaft with a chain and spur gear, and engages the individual hubs. By switching the clutches, the output shaft goes back and forth between forward and reverse rotation. There is also a method of forward/reverse rotation that uses two motors.





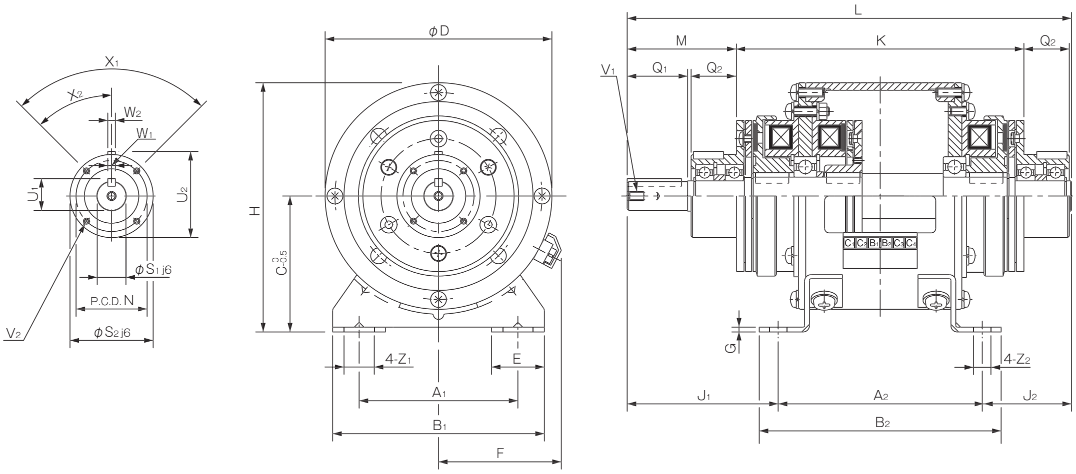
122 Models Double Clutch/Brake Units

Specifications

Model	Size	Dynamic friction torque T_d [N·m]	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Total work performed until readjustment of the air gap E_T [J]	Armature pull-in time t_a [s]	Torque build-up time t_p [s]	Torque decaying time t_d [s]	Mass [kg]
				Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
122-06-20G	06	5	5.5	DC24	11	0.46	52	B	3000	2.19×10^{-4}	36×10^{6}	C:0.020 B:0.015	C:0.041 B:0.033	C:0.020 B:0.015	4
122-08-20G	08	10	11	DC24	15	0.63	38	B	3000	6.55×10^{-4}	60×10^{6}	C:0.023 B:0.016	C:0.051 B:0.042	C:0.030 B:0.025	6
122-10-20G	10	20	22	DC24	20	0.83	29	B	3000	2.12×10^{-3}	130×10^{6}	C:0.025 B:0.018	C:0.063 B:0.056	C:0.050 B:0.030	9
122-12-20G	12	40	45	DC24	25	1.09	23	B	3000	6.35×10^{-3}	250×10^{6}	C:0.040 B:0.027	C:0.115 B:0.090	C:0.065 B:0.050	17
122-16-20G	16	80	90	DC24	35	1.46	16	B	3000	1.99×10^{-2}	470×10^{6}	C:0.050 B:0.035	C:0.160 B:0.127	C:0.085 B:0.055	29
122-20-20G	20	160	175	DC24	45	1.88	13	B	2500	6.15×10^{-2}	10×10^{8}	C:0.090 B:0.065	C:0.250 B:0.200	C:0.130 B:0.070	58

* The dynamic friction torque, T_d, is measured at a relative speed of 100 min⁻¹.

Dimensions



Unit [mm]

Size	Dimensions of part																	
	A_1	A_2	B_1	B_2	C	D	E	F	G	H	J_1	J_2	K	L	M	N	Z_1	Z_2
06	65	90	90	105	65	100	27.5	61	2.6	115	73	48	142	211	47	33	13.5	6.5
08	80	110	110	130	80	125	32.5	72	3.2	142.5	83	53	162	246	57	37	15.5	9
10	105	135	140	160	90	150	35	81	3.2	165	100	59	190	294	72	47	20	11.5
12	135	160	175	185	112	190	42.5	97	4.5	207	124	74	222	358	93	52	24.5	11.5
16	155	200	200	230	132	230	45	109	6	247	150.5	89.5	272	440	114.5	62	28	14
20	195	240	240	270	160	290	47.5	124	20	305	197	114	348	551	143	74.5	28	14

Size	Dimensions of shaft										
	Q_1	Q_2	S_1	S_2	U_1	U_2	V_1	V_2	X_1	X_2	$W_{1,2}$
06	25	20	11	38	12.5	39.5	M4 × 0.7, length: 8	3-M4 × 0.7, length: 4	3-120°	60°	4
08	30	25	14	45	16	47	M4 × 0.7, length: 8	3-M4 × 0.7, length: 6	3-120°	60°	5
10	40	30	19	55	21	57	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	5
12	50	40	24	64	27	67	M6 × 1, length: 11	4-M4 × 0.7, length: 8	4-90°	45°	7
16	60	50	28	75	31	78	M6 × 1, length: 11	6-M5 × 0.8, length: 8	6-60°	30°	7
20	80	60	38	90	41.5	93.5	M10 × 1.5, length: 17	4-M6 × 1, length: 12	4-90°	45°	10

* The output keyways are old JIS standard class 2 while the key is old JIS standard class 1. Note that the keyway dimensions of the unit hub part do not conform to the old JIS standard. Check them on the dimensions table above.

* When inserting pulleys or the like onto output shafts, use the supplied insertion set.

* The 122-20-20G base is a casting.

How to Place an Order

122-06-20G

Size

List of Stand-alone Clutches and Brakes Used

Model	Stand-alone clutch system	Stand-alone braking system	Bearing number	
			Main shaft part	Hub part
122-06-20G	101-06-15G 24V R15JIS A12JIS	111-06-12G 24V 15JIS	6202	6001
122-08-20G	101-08-15G 24V R20JIS A15JIS	111-08-12G 24V 20JIS	6004	6002
122-10-20G	101-10-15G 24V R25JIS A20JIS	111-10-12G 24V 25JIS	6205	6004
122-12-20G	101-12-15G 24V R30JIS A25JIS	111-12-12G 24V 30JIS	6206	6005
122-16-20G	101-16-15G 24V R40JIS A30JIS	111-16-12G 24V 40JIS	6208	6006
122-20-20G	101-20-15G 24V R50JIS A40JIS	111-20-12G 24V 55JIS	6211	6008

Recommended Power Supplies and Accessory Parts

Model	Recommended power supplies	Accessory parts				
		Circuit protector (Varistor), qty. 3	Tightening collar	Screw stock	Presser foot	Hexagonal nut
122-06-20G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
122-08-20G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 3	Qty. 1	M4, qty. 3
122-10-20G	BES-20-10	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 2/M6 × 100, qty. 1	Qty. 1	M4, qty. 2/M6, qty. 2
122-12-20G	BES-20-16	NVD07SCD082 or an equivalent	Qty. 1	M4 × 55, qty. 2/M6 × 100, qty. 1	Qty. 1	M4, qty. 2/M6, qty. 2
122-16-20G	BES-20-16	NVD07SCD082 or an equivalent	Qty. 1	M5 × 70, qty. 2/M6 × 100, qty. 1	Qty. 1	M5, qty. 2/M6, qty. 2
122-20-20G	BES-20-20	NVD07SCD082 or an equivalent	Qty. 1	M6 × 160, qty. 2/M10 × 220, qty. 1	Qty. 1	M6, qty. 2/M10, qty. 2

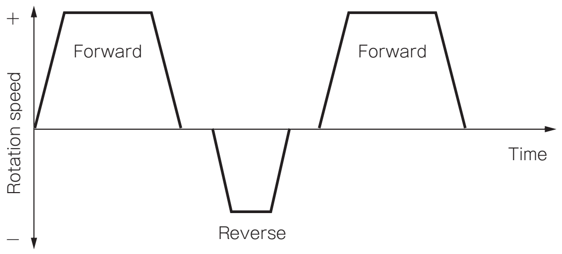
* NVD□SCD□ parts are manufactured by KOA Corporation.

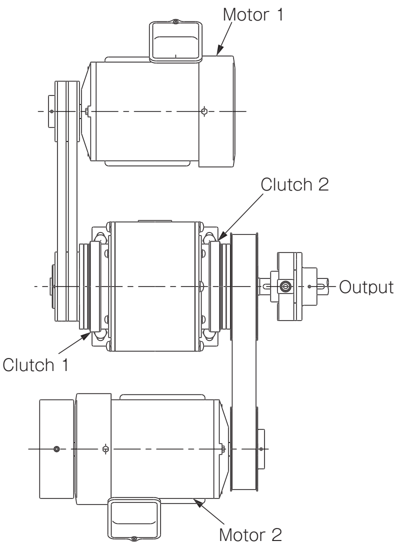
* Recommended BES power supplies are available for each clutch/brake. Varistors need not be used when a BES model is used. For details, refer to the section on power supplies.

Mounting Example

Example When Used in Forward/Reverse Operation

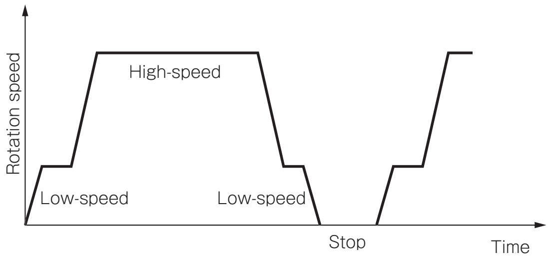
This is an example of forward/reverse rotation using two motors. The motor rotates continuously, forward and reverse operation are achieved by switching clutches, and any load can be stopped during that period.

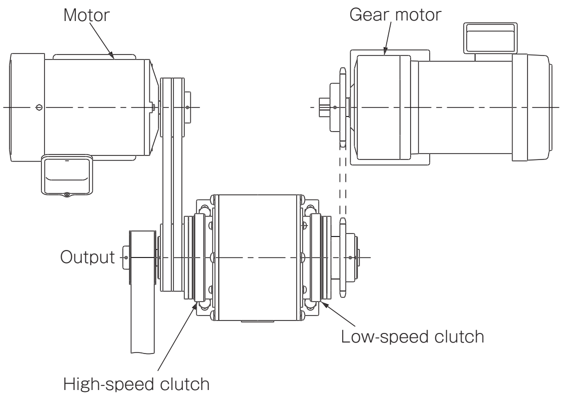




Example When Used in Two-step Speed Change/Stop

High-precision stopping at a predetermined position, winding control on winders, and the like can be controlled simply and with high precision by using this unit to perform a series of operations: slow, fast, slow, stop.





ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

The Selection Process

Key Issues for Selection

Because of their good controllability, clutches and brakes are often used for complex controls rather than simple on/off operations.
If a size is chosen based solely on torque, problems can unexpectedly result.
When choosing a size, many factors must be considered, including load properties and the layout of the mechanism that incorporates the clutch or brake. In this section on selecting sizes, we explain how to make selections for a variety of situations, and also give calculation examples and data needed for selections.

■ Motors and clutches/brakes

- Relationship between motor output and torque

Motor size is expressed as output, but clutches and brakes are expressed as torque. The following relationship obtains between this torque and motor output.

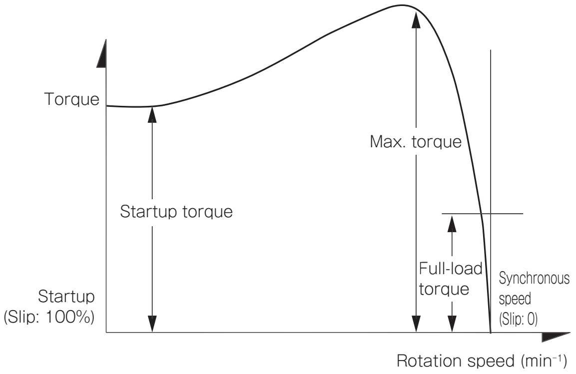
$$T_M = \frac{9550 \cdot P}{n_r} \eta \ [\text{N•m}] \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots \ (1)$$

P: Motor output [kW]
n_r: Rotation speed of clutch/brake shaft [min^{-1}]
η : Transmission efficiency from motor to clutch/brake

- Variance of characteristics

Motors have different torque characteristics from clutches and brakes. That requires that the various characteristics be factored in when using a motor as the drive source and starting and stopping loads with a clutch/brake.

Motor characteristics
Motors can generate torque of 200% of total load torque or more at startup, pass through maximum torque while accelerating, and drive the load near the full load torque that enables stable operation. If load increases during rotation, the motor can lower its own rotation speed and drive the load at a rotation speed that generates high torque. The figure below shows the relationship between motor torque and rotation speed characteristics.

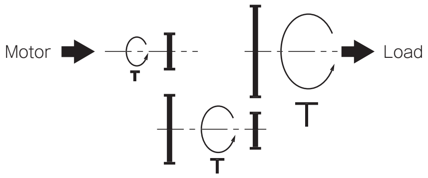


Clutch/brake torque characteristics
The clutch/brake characteristics are determined by the upper limits of engaging and braking torque, as described in the section on torque characteristics. Load torque beyond that causes slipping at the frictional surface.
Knowing these differences in characteristics from the beginning enables you to select the clutch/brake suited for your load conditions. A clutch/brake that has a torque value that is 200 to 250% of the full load torque of the motor will normally be suited to a wide range of applications, factoring in reasonable safety considerations when selecting it.

■ Relationship between torque and rotation speed

- Torque and rotation speed are inversely proportional

Shafts within machinery that are rotating the fastest can be made to rotate with little force, but decelerated slow-rotating shafts require large amounts of force to make them rotate.
In other words, torque and rotation speed are inversely proportional. This is very important for the selection of clutches and brakes. The size and service life of a clutch or brake can change depending on how fast the shaft it is used on is rotating.



- In combination with speed changers

If you are using the clutch/brake within a mechanism that can change rotation speed, such as a stepless speed changer, you must select a clutch/brake that does not fall short on torque at low speeds and that satisfies needs for response and service life at high speeds.

■ Ascertaining load properties

Clutch and brake engaging time, wear life, and the like will vary with the properties of the load being engaged or braked. For that reason, if the load is not ascertained as accurately as possible, even slight changes in load conditions can mean the system will not work adequately.
As it happens, such load properties are quite diverse, and thus difficult to ascertain. Often, users today will determine them empirically.

- Importance of safety factor

When determining the size of the clutch or brake, determine the required torque by multiplying by an empirically derived factor. Once the drive part has been determined, we use an empirical factor K based on the type of drive source used.
If this factor is too small, slipping and other problems can occur when conditions deteriorate; if it is too large, the load on the driver increases, which can cause driver problems when overloads occur.

Types of drivers	**Motor/ turbine**	**Gasoline engine**	**Diesel engine (1 or 2 cylinder gasoline engine)**
Factor K	2 ~ 2.5	2.5 ~ 2.8	2.8 ~ 3.4

- Load torque and moment of inertia

Load torque comes from resistance from the machinery and from resistance applied after engagement (cutting resistance, etc.).
Load torque is generally difficult to determine and is therefore sometimes ignored during size selection. For clutches, however, this can lead to inadequate torque, so it requires attention.
Moment of inertia is also called the flywheel effect. It is a quantity that represents the difficulty of getting an object to move or the difficulty of stopping it.
When designing a mechanism, the work of the clutch and brake are lessened by making the load on the clutch as small as possible while making the brake load somewhat larger. If the moment of inertia is made as small as possible, response and service life are improved.
And since the clutch and brake have inertia of their own, that inertia must be added to calculations.

Selection

Simple Selection Graph

This selection graph applies to cases in which the drive source is a motor, load is relatively light, and frequency is low. The clutch/brake size can be determined easily when the motor used is appropriate to the load, the mechanism between motor and clutch/brake is not complex, and there is no high-inertia body to assist drive.

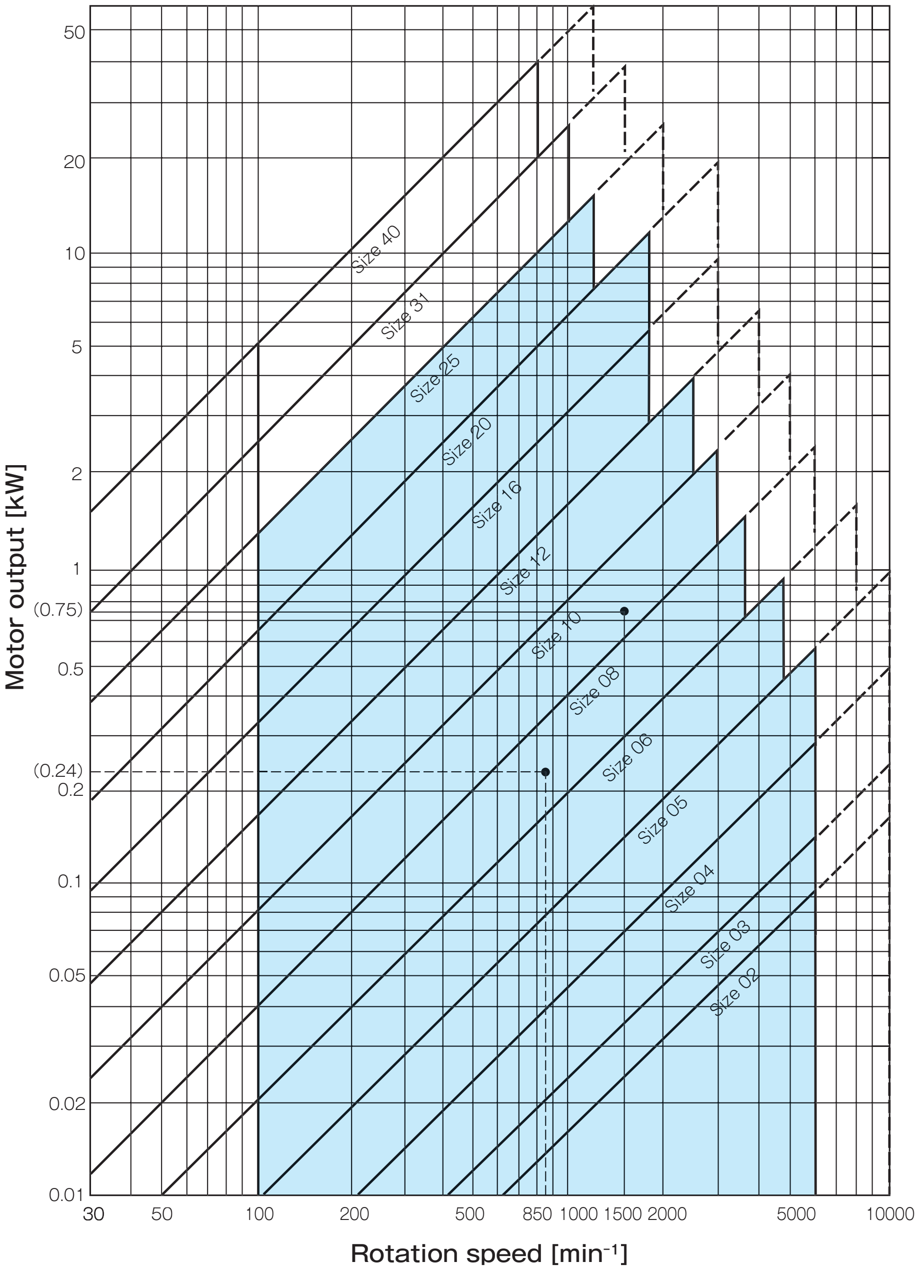
This table is for a safety factor K of 2.5 (ordinary use). You can use this table to select a clutch/brake with other factors. For the vertical axis [kW], use the value obtained by multiplying the motor output by K/2.5.

Selection example

- If the motor output is 0.75 kW and the clutch/brake rotation speed is 1500 min^{-1}, select the size at their intersection, which is size 10.
- To get K = 1.5 when the motor output is 0.4 kW and the clutch/brake rotation speed is 850 min^{-1}:

$$0.4\ [\text{kW}] \times \frac{1.5}{2.5} = 0.24\ [\text{kW}]$$

Find 0.24 kW on the vertical axis of the table and find the intersection with 850 min^{-1}. The size to select is size 08.



* Select the size in the 🟦 area. Inside the dotted line area on the right, the amount of energy, heat dissipation, friction or the like may not satisfy requirements, so check them.
Within the bold line under 100 min^{-1}, use the equation to check the required torque.

* Contact Miki Pulley regarding sizes 31 and 40.

ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Consideration of Torque

■ Total load torque of motor (T_M)

The total load torque translated to the clutch/brake mounting shaft is:

$$T_M = \frac{9550 \cdot P}{n_r} \eta \text{ [N•m]} \quad \cdots\cdots (1)$$

P: Motor output [kW]

n_r: Rotation speed of clutch/brake shaft [min^{-1}]

η : Transmission efficiency from motor to clutch/brake

■ Load torque (T_ℓ)

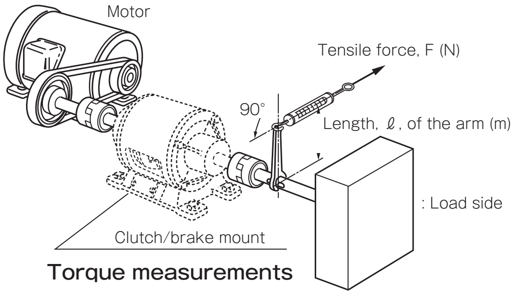
Load torque is difficult to determine through calculations, so it is either determined empirically or by direct measurement.

- When determined from motor capacity
  To select a motor correctly for a load, the T_M of Eq. (1) is used as the load torque.

$$T_\ell = T_M \text{ [N•m]} \quad \cdots\cdots (2)$$

- When measured and then determined
  The load can be actually measured to find an accurate T_ℓ . It can be measured using a torque wrench, or, as in the figure below, the shaft where the clutch or brake will be mounted can be rotated and the value found as the product of the force F to start the load rotating and the length of the arm ℓ .

$$T_\ell = \ell \cdot F \text{ [N•m]} \quad \cdots\cdots (3)$$



Torque measurements

- Sign of load torque
  Load torque in the equation is shown with a plus or minus sign. For a clutch, it is applied in the direction that opposes rotation, so it is subtracted from clutch torque T_d; for a brake, it is applied in the direction that assists braking, so it is added to brake torque T_d. (In the rare cases in which it works the opposite way, change the signs when calculating.) In the equation, it is expressed as $\pm T_\ell$. Use the value as appropriate.

■ Acceleration/deceleration torque (T_a)

- The torque required to accelerate a load is:

$$T_a = \frac{J \cdot n_r}{9.55 t_{ae}} \text{ [N•m]} \quad \cdots\cdots (4)$$

t_{ae}: Actual engagement time (acceleration time) of clutch [s]

J: Total moment of inertia engaged by the clutch [kg・m^2]

- The torque required to decelerate a load is:

$$T_a = \frac{J \cdot n_r}{9.55 t_{ab}} \text{ [N•m]} \quad \cdots\cdots (5)$$

t_{ab}: Actual braking time (deceleration time) of brake [s]

J: Total moment of inertia braked by the brake [kg・m^2]

■ Required torque (T)

Torque required to drive (brake) a load may be as follows, depending on conditions.

- When J and T_ℓ are applied while engaged

$$T = (T_a \pm T_\ell)K \text{ [N•m]} \quad \cdots\cdots (6)$$

K is a factor based on load conditions, which has been empirically found to have values like the following. The sign of T_ℓ is positive for a clutch, since T_ℓ works in the direction that opposes driving, and negative for a brake, since it works in the direction that assists braking.

- When T_ℓ is nearly all that is applied

$$T = T_\ell \cdot K \text{ [N•m]} \quad \cdots\cdots (7)$$

- When J is nearly all that is applied

$$T = T_a \cdot K \text{ [N•m]} \quad \cdots\cdots (8)$$

- For stationary engagement
  When engaging the clutch while stationary and then accelerating the load with the driver, the required torque so that the clutch does not slip when accelerating is:

$$T = \left\{ \frac{J_\ell}{J_d + J_\ell} (T_M - T_\ell) + T_\ell \right\} K \text{ [N•m]} \quad \cdots\cdots (9)$$

J_d: Total drive-side J from clutch [kg•m^2]

J_ℓ : Total load-side J from clutch [kg•m^2]

Safety factor based on load conditions: K

Usage conditions		Factor K
Light load	Low-frequency use of small inertial body	1.5
	High-frequency use of relatively small inertial body Ordinary use of normal inertial body	2 ～ 2.2
	High-frequency use	2.2 ～ 2.4
Normal load	Low-frequency use of small inertial body	2 ～ 2.4
	Ordinary use	2.4 ～ 2.6
	Driving large inertial body	2.7 ～ 3.2
Heavy load	Operation with shock (large load fluctuation)	3.5 ～ 4.5

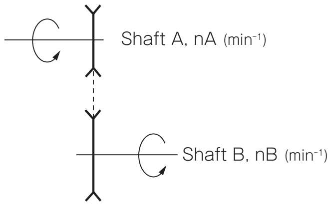
■ Translation of torque to other shafts

For the torque of shaft B to be translated to shaft A:

$$T_A = T_B \cdot \frac{n_B}{n_A} \text{ [N•m]} \quad \cdots\cdots (10)$$

T_A: Torque of shaft A, T_B: Torque of shaft B [N•m]

n_A: Rotation speed of shaft A, n_B: Rotation speed of shaft B [min^{-1}]



Consideration of Energy

Engaging or braking energy (E_e, E_b)

The energy when a clutch or brake engages or brakes once is:

- For acceleration, engaging energy E_e is:

$$E_e = \frac{J \cdot n_r^2}{182} \cdot \frac{T_d}{T_d - T_\ell} \text{ [J]} \quad \cdots\cdots (11)$$

- For deceleration, braking energy E_b is:

$$E_b = \frac{J \cdot n_r^2}{182} \cdot \frac{T_d}{T_d + T_\ell} \text{ [J]} \quad \cdots\cdots (12)$$

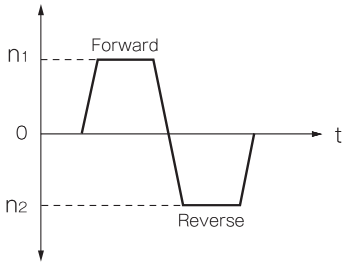
- Forward/reverse rotation

  The engaging energy of the clutch when using the clutch to switch rotation direction is:

$$E_e = \frac{J}{182} \left\{ (n_1^2 + 2 \cdot n_1 \cdot n_2) \frac{T_d}{T_d + T_\ell} + n_2^2 \frac{T_d}{T_d - T_\ell} \right\} \text{ [J]} \quad \cdots (13)$$

n_1: Forward rotation speed [min^{-1}]

n_2: Reverse rotation speed [min^{-1}]



- Energy when using slip

$$E_e = \frac{2\pi}{60} \cdot n \cdot t \cdot T_d \text{ [J]} \quad \cdots\cdots (14)$$

$$E_b = \frac{2\pi}{60} \cdot n \cdot t \cdot T_d \text{ [J]} \quad \cdots\cdots (15)$$

t: Slip time [s]

n: Rotation speed that forces slip [min^{-1}]

T_d: Dynamic friction torque at n [min^{-1}] [N•m]

If the clutch or brake slips as it is being used, unwanted situations such as heat generation can occur, so perform adequate checks.

- Allowable work

  Allowable work $E_{ea\ell}$ and $E_{ba\ell}$ are the values under ideal conditions, so the values of E_e and E_b must be sufficiently smaller than the values of $E_{ea\ell}$ and $E_{ba\ell}$.

$$E_e \ll E_{ea\ell} \quad \cdots\cdots (16)$$

$$E_b \ll E_{ba\ell} \quad \cdots\cdots (17)$$

* For the values of $E_{ea\ell}$ and $E_{ba\ell}$, see the page on heat dissipation characteristics (P.321).

Energy rate

Since clutches and brakes turn on and off at relatively high frequencies, it is important to investigate whether accumulated heat can be dissipated.

- Engaging energy rate (P_e)

$$P_e = \frac{E_e \cdot S}{60} \ll P_{ea\ell} \text{ [W]} \quad \cdots\cdots (18)$$

- Braking energy rate (P_b)

$$P_b = \frac{E_b \cdot S}{60} \ll P_{ba\ell} \text{ [W]} \quad \cdots\cdots (19)$$

S: Frequency of operation [RPM]

Allowable energy rates $P_{ea\ell}$ and $P_{ba\ell}$ are the values under ideal conditions, so E_e, E_b and S must be set so these rates are sufficiently small.

* For the values of $E_{ea\ell}$ and $E_{ba\ell}$, see the page on heat dissipation characteristics (P.321).

Frequency of engaging/braking (S_a)

The allowable operating frequency S_a determined by heat dissipation is:

$$S_a \ll \frac{60P_{ea\ell}}{E_e} \text{ [RPM]} \quad \cdots\cdots (20)$$

$$S_a \ll \frac{60P_{ba\ell}}{E_b} \text{ [RPM]} \quad \cdots\cdots (21)$$

This allowable frequency reflects only thermal considerations; in actual use, operating time should also be considered.

Consideration of Operating Time

Total engagement/braking time (t_{te}, t_{tb})

The time the load is engaged or braked by the clutch or brake is the sum of the operating time of the clutch or brake itself and the accelerating/deceleration time.

- Total engagement time

$$t_{te} = t_{id} + t_a + 01 t_{ae} \text{ [s]} \quad \cdots\cdots (22)$$

t_{id}: Initial delay time [s]

t_a: Armature pull-in time [s]

t_{ae}: Actual clutch engagement time (acceleration time) [s]

- Total braking time

$$t_{tb} = t_{id} + t_a + t_{ab} \text{ [s]} \quad \cdots\cdots (23)$$

t_{id}: Initial delay time [s]

t_a: Armature pull-in time [s]

t_{ab}: Actual braking time (deceleration time) of brake [s]

t_{ae} and t_{ab} are found using the following equations based on operating conditions.

- When accelerating/decelerating

  Actual engagement time is:

$$t_{ae} = \frac{J \cdot n_r}{9.55(T_d - T_\ell)} \text{ [s]} \quad \cdots\cdots (24)$$

Actual braking time is:

$$t_{ab} = \frac{J \cdot n_r}{9.55(T_d + T_\ell)} \text{ [s]} \quad \cdots\cdots (25)$$

- During forward/reverse rotation

  The actual engagement time (acceleration time) when switching from forward to reverse with a clutch is:

$$t_{ae} = \frac{J}{9.55} \left(\frac{n^1}{T_d - T_\ell} + \frac{n^2}{T_d + T_\ell} \right) \text{ [s]} \quad \cdots\cdots (26)$$

n_1: Forward rotation speed [min^{-1}]

n_2: Reverse rotation speed [min^{-1}]

ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

■ Engaging/braking time when engaging/braking is completed during the torque rise process

In this case, it is the sum of the armature pull-in time t_a and t_{ae}' or t_a and t_{ab}'.

- Total engagement time

$$t_{te} = t_{id} + t_a + t_{ae}' \ [s] \quad \cdots\cdots(27)$$

$$t_{ae}' = \sqrt{\frac{J \cdot n_r}{4.77} \bullet \frac{t_{ap}}{0.8 \cdot T_d}} \ [s] \quad \cdots\cdots(28)$$

- Total braking time

$$t_{tb} = t_{id} + t_a + t_{ab}' \ [s] \quad \cdots\cdots(29)$$

$$t_{ab}' = \sqrt{\frac{J \cdot n_r}{4.77} \bullet \frac{t_{ap}}{0.8 \cdot T_d}} \ [s] \quad \cdots\cdots(30)$$

These are when $T_\ell = 0$. Generally, the above equation is used only when load torque (T_ℓ) is very small. When, for calculated values, $t_{ae}' > t_{ap}$ and $t_{ab}' > t_{ap}$, use equations (22) to (26).

Consideration of Number of Operations

The amount of work that a clutch or brake can do before the air gap is adjusted is predetermined. When used beyond that point, the air gap must be adjusted. The number of operations that can be done before air gap adjustment is:

- For a clutch

$$L_e = \frac{E_T}{E_e} \ [\text{operations}] \quad \cdots\cdots(31)$$

E_T: Total work performed until readjustment of the air gap

- For brakes

$$L_b = \frac{E_T}{E_b} \ [\text{operations}] \quad \cdots\cdots(32)$$

Consideration of Stopping Precision

Finding stopping precision by calculating is very difficult, since friction energy, control system fluctuations and the like are involved. Generally, it is found empirically with the following equation, and that is then used as a guide.

■ Stopping angle (θ)

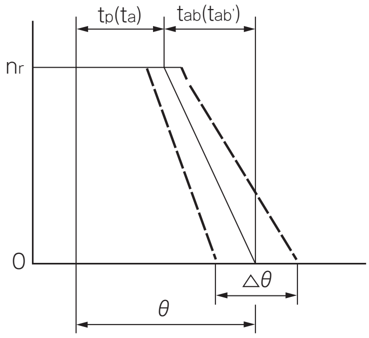
$$\theta = 6n_r(t_{id} + t_p + \frac{1}{2} t_{ab}) \ [°] \quad \cdots\cdots(33)$$

$$\text{Or, } \theta = 6n_r(t_{id} + t_a + \frac{2}{3} t_{ab}') \ [°] \quad \cdots\cdots(34)$$

■ Stopping precision (△θ)

$$\triangle\theta = \pm 0.15\ \theta \ [°] \quad \cdots\cdots(35)$$

When there are factors that disrupt braking such as load fluctuation, use a value between 0.2 and 0.25 as the constant in Eq. (35) for safety reasons. Note that the stopping angle and stopping precision do not include divergences due to control system delays, or backlash from chains, gears, or the like.



Total Work Performed Until Readjustment of the Air Gap E_T

Electromagnetic Micro Clutches & Micro Brakes 102/112 Models

Size	Total work E_T [J]
02	2×10^6
03	3×10^6
04	6×10^6
05	9×10^6

CYT Models

Size	Total work E_T [J]
025	1×10^6
03	1.5×10^6
04	2×10^6

Electromagnetic Clutch/Brake (Units) 101/CS/111 Models

Size	Total work E_T [J]
06	36×10^6
08	60×10^6
10	130×10^6
12	250×10^6
16	470×10^6
20	10×10^8
25	20×10^8

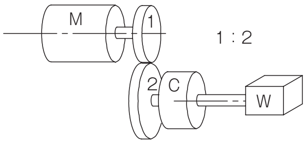
* Also applies to all unit models (except models 180).

CSZ and BSZ Models

Size	Total work E_T [J]
05	9×10^6
06	29×10^6
08	60×10^6

Selection Example 1

Clutches used for intermittent transport of loads



Selection of a clutch to use to intermittently transport loads as follows, as the figure illustrates.

Usage conditions

Output of motor used	P	0.4 kW (standard 3-phase, 4P)
Clutch operation frequency	S	20 [RPM]
Moment of inertia of load	J_A	0.0208 [kg·m^2]
Load torque	T_ℓ	Unknown [N•m]
Clutch mounting shaft rotation speed	n	750 [min^{-1}]
Transmission rate	η	90%

■ Consideration of Torque

We find the required torque for engagement from the above operating conditions.
First, we find the load torque. Based on Eq. (1), load torque T_ℓ (assuming the motor was selected correctly) is:

$$T_\ell = \frac{9550 \times 0.4}{750} \times 0.9 = 4.58\ [\text{N•m}]$$

Next, according to Eq. (4), the acceleration torque T_a is:

$$T_a = \frac{0.0208 \times 750}{9.55 \times 0.5} = 3.27\ [\text{N•m}]$$

The acceleration time is given as a condition, but in the above equation is it projected as $t_{ae} = 0.5$ [s] based on the operation frequency.
Thus, the required torque (T), according to Eq. (6), is:

$$T = (4.58 + 3.27) \times 2 = 15.7\ [\text{N•m}]$$

Here, the sign of the load torque T_ℓ is +. The factor K for load conditions was empirically set at 2 for general use with ordinary loads.
From the above, the clutch is size 10, which is a clutch that has torque (20 N•m) above the required torque of 15.7 [N•m].

■ Consideration of Energy

Having determined the model, we find the total load moment of inertia from the self-inertia J of that type and the load moment of inertia.
With the model as 101-10-13, the moment of inertia J of the rotor is 0.000678 [kg•m^2]. Thus, the total moment of inertia J_{Total}' is:

$$J_{Total}' = 0.0208 + 0.000678 = 0.02148\ [\text{kg•m}^2]$$

We find the engaging energy E_e for a single operation. From Eq. (11)

$$E_e = \frac{0.02148 \times 750^2}{182} \times \frac{20}{(20 - 4.58)} = 86.1\ [\text{J}]$$

Here, the sign of the load torque T_ℓ is -. This engaging energy E_e is sufficiently below the allowable energy $E_{ea\ell}$.

$$E_e \ll E_{ea\ell}$$

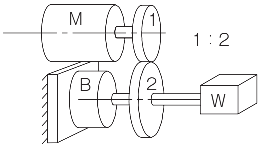
Next, we find the energy rate. From Eq. (18)

$$P_e = \frac{86.1 \times 20}{60} = 28.7\ [\text{W}]$$

This value is sufficiently below the allowable energy rate $P_{ea\ell}$.
Thus, this clutch is suited to the operating conditions, and model 101-10-13 is selected.

Selection Example 2

Brakes that stop momentum when motor goes off



Selection of a brake to stop the momentum of a load when a motor is turned off as follows, as the figure illustrates.

Usage conditions

Output of motor used	P	0.75kW (standard 3-phase, 4P)
Motor rotation speed	n_1	1800 [min^{-1}]
Moment of inertia of motor	J_M	0.00205 [kg·m^2]
Moment of inertia of V pulley (motor side)	J_1	0.00075 [kg·m^2]
Moment of inertia of V pulley (brake side)	J_2	0.00243 [kg·m^2]
Moment of inertia of load	J_A	0.05 [kg·m^2]
Load torque	T_ℓ	5.0 [N•m]
Brake mounting shaft rotation speed	n	900 [min^{-1}]
Stopping time	t	Within 0.5 [s]

■ Consideration of Torque

From the above operating conditions, find the total moment of inertia translated to the brake shaft.

$$J_{Total} = \left(\frac{1800}{900}\right)^2 \times (0.00205 + 0.00075) + 0.00243 +$$
$$0.05 = 0.06363\ [\text{kg•m}^2]$$

We find the deceleration torque. The deceleration time also includes the operating time of the brake itself, so calculate it as 1/2 of the given stopping time.
From Eq. (5)

$$T_a = \frac{0.06363 \times 900}{9.55 \times 0.25} = 24.0\ [\text{N•m}]$$

The required torque from Eq. (6) is:

$$T = (24.0 - 5.0) \times 2.4 = 45.6\ [\text{N•m}]$$

Here, the sign of the load torque T_ℓ is -. The factor K for load conditions was empirically set at 2.4 for general use with ordinary loads.
From the above, size 12, which has brake torque (40 N•m) equivalent to the required torque of 45.6 [N•m], was provisionally selected

■ Consideration of Energy

Having determined the model, we find the total load moment of inertia from the self-inertia J of that type and the load moment of inertia.
With the model as 111-12-11, the moment of inertia J of the armature is 0.00181 [kg•m^2]. Thus, the total moment of inertia J_{Total}' is:

$$J_{Total}' = 0.06363 + 0.00181 = 0.06544\ [\text{kg•m}^2]$$

Find the braking energy E_b for a single operation. From Eq. (12)

$$E_b = \frac{0.06544 \times 900^2}{182} \times \frac{40}{(40 + 5)} = 258.9\ [\text{J}]$$

Here, the sign of the load torque T_ℓ is +. This braking energy E_b is sufficiently below the allowable energy $E_{ba\ell}$.

$$E_b \ll E_{ba\ell}$$

ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

■ Consideration of Operating Time

We find the braking time. From Eq. (25)

$$t_{ab} = \frac{0.06544 \times 900}{9.55 \times (40 + 5)} = 0.137\ [s]$$

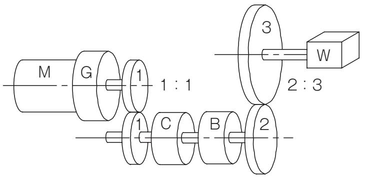
Here, the sign of the load torque T_ℓ is +.
From the specifications table, the armature pull-in time t_a for size 12 is 0.027 [s]. If the initial delay time t_{id} of relays and the like is 0.050 [s],

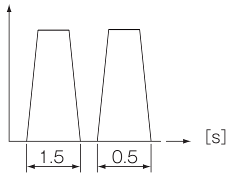
$$t_{tb} = 0.050 + 0.027 + 0.137 = 0.214\ [s]$$

from Eq. (23):
This value satisfies the requirement of being at or below 0.5 [s]. Thus, this brake is suited to the operating conditions, and model 111-12-11 is selected.

Selection Example 3

Clutches and brakes that drive loads





Selection of a clutch and brake to drive the load as follows, as the figure illustrates.

Usage conditions

Operation frequency	S	30 [RPM]
Required service life operations *1	L	810 × 10^4 (operations) or more
Moment of inertia of V pulley A	J_1	0.00195 [kg·m²]
Moment of inertia of V pulley B	J_2	0.01668 [kg·m²]
Moment of inertia of load	J_A	0.5075 [kg·m²]
Load torque	T_ℓ	22.0 [N•m]
Clutch/brake mounting shaft rotation speed	n	150 [min⁻¹]
Load shaft rotation speed	n_2	100 [min⁻¹]
Engagement time	t_1	Within 0.3 [s]
Stopping time	t_2	Within 0.3 [s]

*1: Desired use is 15 hours per day without adjustment for at least 1 year.
L = 30 × 60 min × 15 hr × 300 days = 8.1 million operations

■ Consideration of Torque

From the above operating conditions, load torque is translated to the clutch/brake shaft. From Eq. (10)

$$T_\ell = 22.0 \times \frac{2}{3} = 14.7\ [N{\bullet}m]$$

All of the moment of inertia of the rotating parts is translated to the clutch/brake shaft.

$$J_{Total} = J_{11} + (J_2 + J_A) \times \left(\frac{2}{3}\right)^2$$

$$= 0.00195 + (0.01668 + 0.5075) \times \left(\frac{2}{3}\right)^2$$

$$= 0.2349\ [kg{\bullet}m^2]$$

The acceleration time also includes the operating time of the clutch/brake itself, so calculate it as 1/2 of the given engagement time of 0.3 [s]. From Eq. (4):

$$T_a = \frac{0.2349 \times 150}{9.55 \times 0.15} = 24.6\ [N{\bullet}m]$$

The required torque T from Eq. (6) is:

$$T = (24.5 \pm 14.7) \times K\ [N{\bullet}m]$$

If the factor K for load conditions is empirically set at 2 for general use with ordinary loads, for the clutch we get:

$$T = (24.5 + 14.7) \times 2 = 78.4\ [N{\bullet}m]$$

And for the brake, we get:

$$T = (24.5 - 14.7) \times 2 = 19.6\ [N{\bullet}m]$$

Based on the above, we select a size 16 clutch (torque 80N•m) and size 10 brake (torque 20N•m).

■ Consideration of Energy

Next, having determined the model, we find the total load moment of inertia from the self-inertia J of that type and the load moment of inertia.
If the clutch model is 101-16-15, the moment of inertia of the rotor is 0.0063 [kg•m²]; if the brake model is 111-10-11, the moment of inertia of the armature is 0.000663 [kg•m²].
Thus, the total moment of inertia $J_{Total'}$ is:

$$J_{Total'} = 0.2349 + 0.0063 + 0.000663$$

$$= 0.2419\ [kg{\bullet}m^2]$$

We find the engaging energy of the clutch E_e for a single operation. From Eq. (11)

$$E_e = \frac{0.2419 \times 150^2}{182} \times \frac{80}{(80 - 14.7)} = 36.6\ [J]$$

We find the braking energy E_b of the brake for a single operation. From Eq. (12)

$$E_b = \frac{0.2419 \times 150^2}{182} \times \frac{20}{(20 + 14.7)} = 17.2\ [J]$$

This value satisfies the allowable energy and the energy per minute of the selected model.

■ Consideration of Number of Operations

Next, we find the number of operations. From the specifications tables for the different models, the total energy of sizes 16 and 10 is, respectively, 470 × 10^6 [J] and 130 × 10^6 [J], so from Eqs. (31) and (32), for the clutch we get:

$$L = \frac{470 \times 10^6}{36.6} = 1284 \times 10^4\ [times]$$

And for the brake, we get:

$$L = \frac{130 \times 10^6}{17.2} = 756 \times 10^4\ [times]$$

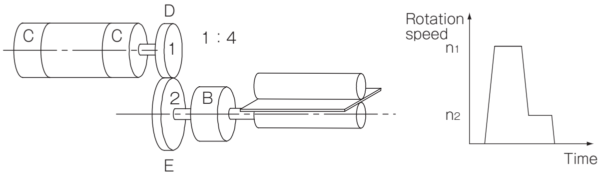
Since the requirement for number of operations in service life is roughly 8.1 million, a size 10 brake cannot satisfy the requirements. When we therefore consider the situation again with a 111-12-11 model brake, we find (leaving out intermediate calculations):

$$L = \frac{250 \times 10^6}{22.0} = 1136 \times 10^4\ [times]$$

This satisfies the requirements. Thus, we select a 101-16-15 model clutch and a 111-12-11 model brake.

Selection Example 4

Clutches and brakes used in two-step speed change/stopping mechanisms



As the figure illustrates, a selection that includes the stopping precision of the clutch and brake that drive the load is as follows.

Usage conditions

Max. input rotation speed	**n_1**	1500 [min^{-1}]
Min. input rotation speed	**n_2**	200 [min^{-1}]
Roll shaft rotation speed	**n_3**	50 [min^{-1}]
Operation frequency	**S**	12 [RPM]
Required service life operations [*1]	**L**	130 × 10^4 (operations) or more
Moment of inertia of pulley D	**J_1**	0.000025 [kg·m^2]
Moment of inertia of pulley E	**J_2**	0.005375 [kg·m^2]
Moment of inertia of roll	**J_A**	0.0133 [kg·m^2]
Load torque of roll	**T_ℓ**	8.0 [N•m]
Roll diameter	**R**	60 [mm]

* 1: Desired use is 6 hours per day without adjustment for at least 1 year.
L = 12 × 60 min × 6 hr × 300 days = 1.3 million operations

■ Consideration of Brake

- Consideration of energy

From the above operating conditions, we find the total moment of inertia translated to the feed roll shaft. If the moment of inertia of the rotating parts of clutch/brake unit model 121-08-10 is 0.000475 [kg•m^2] and the moment of inertia of the armature of brake model 111-12-12 is 0.00181 [kg•m^2],

$$J_{Total} = 0.0133 \times 2 + 0.00181 + 0.005375$$
$$+ \ (0.000025 + 0.000475) \times \left(\frac{4}{1}\right)^2$$
$$= 0.04179\ [kg•m^2]$$

Find the braking energy E_b for a single operation. From Eq. (12):

$$E\ b = \frac{0.04179 \times 50^2}{182} \times \frac{40}{(40 + 8)} = 0.48\ [J]$$

Here, the sign of the load torque T_ℓ is +. This value satisfies the allowable energy and the energy per minute of the selected model.

- Consideration of number of operations

Next, we find the number of operations. The total energy of size 12 is 250 × 10^6 [J], so from Eq. (32):

$$L = \frac{250 \times 10^6}{0.48} = 52083 \times 104\ [times]$$

This value adequately satisfies the requirements.

■ Consideration of Operating Time

We find the braking time.

We can use either Eq. (25) or Eq. (30), but we use Eq. (30) because the braking time is then shorter. Here, the torque increase time t_{ap} of the brake is 0.063 [s], so from Eq. (30), braking time t_{ab}' is:

$$t_{ab}' = \sqrt{\frac{0.04179 \times 50}{4.77} \times \frac{0.063}{(0.8 \times 40)}}$$
$$= 0.0294\ [S]$$

- Consideration of stopping precision

If the initial delay time t_{id} of relays and the like is 0.050 [s], from Eq. (34), the stopping angle is:

$$\theta = 6 \times 50 \times \left(0.050 + 0.027 + \frac{2}{3} \times 0.0294\right)$$
$$= 28.98\ [°]$$

From Eq. (35), the stopping precision is:

$$\triangle\theta = \pm 0.15 \times 28.98 = \pm 4.35\ [°]$$

Converting from roll diameter to length on the circumference, we get ± 2.3 [mm].

■ Consideration of Clutch

- Consideration of energy

From the above operating conditions, we find the total moment of inertia translated to the clutch shaft.

$$J_{Total'} = 0.000475 + 0.000025 +$$
$$(0.00181 + 0.0133 \times 2 + 0.005375 \times \left(\frac{1}{4}\right)^2$$
$$= 0.0026\ [kg•m^2]$$

Load torque translates to the clutch shaft using Eq. (10).

$$T_\ell = 8.0 \times \frac{1}{4} = 2.0\ [N•m]$$

Calculating for the clutch on the high-speed side, the engaging energy E_e for one operation, from Eq. (11), is:

$$E_e = \frac{0.0026 \times 1500^2}{182} \times \frac{10}{(10 - 2)} = 40.2\ [J]$$

This value satisfies the allowable energy of the selected model.

Next, we find the engaging energy rate P_e. From Eq. (18):

$$P_e = \frac{40.2 \times 12}{60} = 8.04\ [W]$$

This value is sufficiently small for the allowable energy rate $P_{ea\ell}$.

- Consideration of number of operations

We find the number of operations. From Eq. (31):

$$L = \frac{60 \times 10^6}{40.2} = 149 \times 10^4\ [times]$$

Since the number of operations over one year is roughly 1.3 million, this meets the requirement.

Next, calculating for the clutch on the low-speed side, the engaging energy E_e for one operation, from Eq. (12), is:

$$E_e = \frac{0.0026 \times \ (1500 - 200)^2}{182} \times \frac{10}{(10 + 2)}$$
$$= 20.1\ [J]$$

This clutch decelerates the load from 1500 (min^{-1}) to 200 (min^{-1}), so it does similar work to the brake. Thus, the sign of the load torque T_ℓ is +. Also, since this value is smaller than the value for the clutch on the high-speed side, it clearly satisfies the requirement for number of operations during the service life.

The above shows that both clutch and brake satisfy conditions.

ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Accessories

Different models and types of clutches and brakes have different accessories. Consult these tables.
Note that we may change accessories as circumstances dictate.

Micro Sizes

Model	Varistor		Screw type		Disc spring washer		Shim [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.
102-02-□1/□5	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
112-02-□1/□2	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
102/112-02-□3	NVD07SCD082 or an equivalent	1	M2 × 3	2	–	–	–	–
CYT-025-33B *ϕ* 6	NVD07SCD082 or an equivalent	1	M2.5 × 4	3	–	–	6.3 × 8.7 × 0.1t	3

Model	Varistor		Screw type		Disc spring washer		Shim [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.
102-03-□1/□5	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
112-03-□1/□2	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
102/112-03-□3	NVD07SCD082 or an equivalent	1	M2.5 × 4	3	–	–	–	–
CYT-03-33□ *ϕ* 6	NVD07SCD082 or an equivalent	1	M2.5 × 4	3	–	–	6.3 × 8.7 × 0.1t	3
CYT-03-33□ *ϕ* 8	NVD07SCD082 or an equivalent	1	M2.5 × 4	3	–	–	8.3 × 11.7 × 0.1t	3

Model	Varistor		Screw type		Disc spring washer		Shim [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.
102-04-□1/□5	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
112-04-□1/□2	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
102/112-04-□3	NVD07SCD082 or an equivalent	1	M3 × 6	3	–	–	–	–
CYT-04-33□ *ϕ* 8	NVD07SCD082 or an equivalent	1	M3 × 6	3	–	–	8.3 × 11.7 × 0.1t	3
CYT-04-33□ *ϕ* 10	NVD07SCD082 or an equivalent	1	M3 × 6	3	–	–	10.3 × 13.7 × 0.1t	3

Model	Varistor		Screw type		Disc spring washer		Shim [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.
102-05-□1/□5	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
112-05-□1/□2	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–
102/112-05-□3	NVD07SCD082 or an equivalent	1	M3 × 6	3	M3	3	–	–
CSZ/BSZ-05-□	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–

* Only the screws supplied with 102/112-05-□3 are hex-socket low-head bolts. All others are Phillips pan-head machine screws.

Standard Sizes

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101/CS-06-□1	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–
101/CS-06-□3 *ϕ* 12	NVD07SCD082 or an equivalent	1	M3 × 6	3	M3	3	12.3 × 15.7 × 0.1t	3	–	–	–	–
101-06-13 *ϕ* 15	NVD07SCD082 or an equivalent	1	M3 × 6	3	M3	3	15.3 × 20.7 × 0.1t	3	–	–	–	–
101/CS-06-□5 *ϕ* 12	NVD07SCD082 or an equivalent	1	–	–	–	–	12.3 × 15.7 × 0.1t	5	12.3 × 15.7 × 0.5t	1	12.2 × 18 × 5.5	1
111-06-11 *ϕ* 12/ *ϕ* 15	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–
111-06-12 *ϕ* 12	NVD07SCD082 or an equivalent	1	–	–	–	–	12.3 × 15.7 × 0.1t	3	–	–	–	–
111-06-12 *ϕ* 15	NVD07SCD082 or an equivalent	1	–	–	–	–	15.3 × 20.7 × 0.1t	3	–	–	–	–
111-06-13	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–
CSZ/BSZ-06-□	NVD07SCD082 or an equivalent	1	M3 × 6	3	M3	3	–	–	–	–	–	–

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101/CS-08-□1	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–
101/CS-08-□3 *ϕ* 15	NVD07SCD082 or an equivalent	1	M4 × 8	3	M4	3	15.3 × 20.7 × 0.1t	3	–	–	–	–
101-08-13 *ϕ* 20	NVD07SCD082 or an equivalent	1	M4 × 8	3	M4	3	20.3 × 27.7 × 0.1t	3	–	–	–	–
101/CS-08-□5 *ϕ* 15	NVD07SCD082 or an equivalent	1	–	–	–	–	15.3 × 20.7 × 0.1t	5	15.3 × 20.7 × 0.5t	1	15.2 × 22 × 5.5	1
111-08-11 *ϕ* 15/ *ϕ* 20	NVD07SCD082 or an equivalent	1	–	–	–	–	15.3 × 20.7 × 0.5t	1	–	–	–	–
111-08-12 *ϕ* 15	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–
111-08-12 *ϕ* 20	NVD07SCD082 or an equivalent	1	–	–	–	–	15.3 × 20.7 × 0.1t	3	–	–	–	–
111-08-13	NVD07SCD082 or an equivalent	1	M4 × 8	3	M4	3	20.3 × 27.7 × 0.1t	3	–	–	–	–
CSZ/BSZ-08-□	NVD07SCD082 or an equivalent	1	–	–	–	–	–	–	–	–	–	–

Standard Sizes

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101/CS-10-□1	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
101/CS-10-□3 ϕ 20	NVD07SCD082 or an equivalent	1	M5 × 10	3	M5	3	20.3 × 27.7 × 0.1t	3	—	—	—	—
101-10-13 ϕ 25	NVD07SCD082 or an equivalent	1	M5 × 10	3	M5	3	25.3 × 34.7 × 0.1t	3	—	—	—	—
101/CS-10-□5 ϕ 20	NVD07SCD082 or an equivalent	1	—	—	—	—	20.3 × 27.7 × 0.1t	5	20.3 × 27.7 × 0.5t	2	20.2 × 28 × 5.9	1
111-10-11 ϕ 20/ ϕ 25	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
111-10-12 ϕ 20	NVD07SCD082 or an equivalent	1	—	—	—	—	20.3 × 27.7 × 0.1t	3	—	—	—	—
111-10-12 ϕ 25	NVD07SCD082 or an equivalent	1	—	—	—	—	25.3 × 34.7 × 0.1t	3	—	—	—	—
111-10-13	NVD07SCD082 or an equivalent	1	M5 × 10	3	M5	3	—	—	—	—	—	—

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101/CS-12-□1	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
101-12-13 ϕ 25	NVD07SCD082 or an equivalent	1	M6 × 10	3	M6	3	25.3 × 34.7 × 0.1t	3	—	—	—	—
101-12-13 ϕ 30	NVD07SCD082 or an equivalent	1	M6 × 10	3	M6	3	30.3 × 39.7 × 0.1t	3	—	—	—	—
CS-12-33 ϕ 25	NVD07SCD082 or an equivalent	1	M6 × 10	3	M6	3	25.3 × 31.7 × 0.1t	3	—	—	—	—
101/CS-12-□5 ϕ 25	NVD07SCD082 or an equivalent	1	—	—	—	—	25.3 × 31.7 × 0.1t	5	25.3 × 31.7 × 0.5t	2	25.2 × 32 × 7.5	1
111-12-11 ϕ 25/ ϕ 30	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
111-12-12 ϕ 25	NVD07SCD082 or an equivalent	1	—	—	—	—	25.3 × 31.7 × 0.1t	3	—	—	—	—
111-12-12 ϕ 30	NVD07SCD082 or an equivalent	1	—	—	—	—	30.3 × 39.7 × 0.1t	3	—	—	—	—
111-12-13	NVD07SCD082 or an equivalent	1	M6 × 10	3	M6	3	—	—	—	—	—	—

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101/CS-16-□1	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
101-16-13 ϕ 30	NVD07SCD082 or an equivalent	1	M8 × 15	3	M8	3	30.3 × 41.7 × 0.1t	3	—	—	—	—
101-16-13 ϕ 40	NVD07SCD082 or an equivalent	1	M8 × 15	3	M8	3	40.3 × 51.7 × 0.1t	3	—	—	—	—
CS-16-33 ϕ 30	NVD07SCD082 or an equivalent	1	M8 × 15	3	M8	3	30.3 × 39.7 × 0.1t	3	—	—	—	—
101/CS-16-□5 ϕ 30	NVD07SCD082 or an equivalent	1	—	—	—	—	30.3 × 39.7 × 0.1t	5	30.3 × 39.7 × 0.5t	2	30.2 × 40 × 11.2	1
111-16-11 ϕ 30/ ϕ 40	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
111-16-12 ϕ 30	NVD07SCD082 or an equivalent	1	—	—	—	—	30.3 × 39.7 × 0.1t	3	—	—	—	—
111-16-12 ϕ 40	NVD07SCD082 or an equivalent	1	—	—	—	—	40.3 × 51.7 × 0.1t	3	—	—	—	—
111-16-13	NVD07SCD082 or an equivalent	1	M8 × 15	3	M8	3	—	—	—	—	—	—

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101-20-11	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
101-20-13 ϕ 40	NVD07SCD082 or an equivalent	1	M10 × 18	3	M10	3	40.3 × 51.7 × 0.1t	3	—	—	—	—
101-20-13 ϕ 50	NVD07SCD082 or an equivalent	1	M10 × 18	3	M10	3	50.3 × 67.7 × 0.1t	3	—	—	—	—
CS-20-33 ϕ 40	NVD07SCD082 or an equivalent	1	M10 × 18	3	M10	3	40.3 × 51.7 × 0.1t	5	—	—	—	—
101-20-15 ϕ 40	NVD07SCD082 or an equivalent	1	—	—	—	—	40.3 × 51.7 × 0.1t	5	40.3 × 51.7 × 0.5t	2	40.2 × 50 × 11.7	1
111-20-11 ϕ 40/ ϕ 50	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
111-20-12 ϕ 40	NVD07SCD082 or an equivalent	1	—	—	—	—	40.3 × 51.7 × 0.1t	3	—	—	—	—
111-20-12 ϕ 50	NVD07SCD082 or an equivalent	1	—	—	—	—	50.3 × 67.7 × 0.1t	3	—	—	—	—
111-20-13	NVD07SCD082 or an equivalent	1	M10 × 18	3	M10	3	—	—	—	—	—	—

Model	Varistor		Low head bolt		Disc spring washer		Shim 1 [mm]		Shim 2 [mm]		Collar [mm]	
	Model	Qty.	Standards	Qty.	Standards	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.	Internal dia. × External dia. × Thickness	Qty.
101-25-11	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
101-25-13 ϕ 50	NVD07SCD082 or an equivalent	1	M12 × 22	4	M12	4	50.3 × 67.7 × 0.1t	3	—	—	—	—
101-25-13 ϕ 60	NVD07SCD082 or an equivalent	1	M12 × 22	4	M12	4	60.3 × 84.7 × 0.1t	3	—	—	—	—
CS-25-33 ϕ 50	NVD07SCD082 or an equivalent	1	M12 × 22	4	M12	4	50.3 × 67.7 × 0.1t	5	—	—	—	—
101-25-15 ϕ 50	NVD07SCD082 or an equivalent	1	—	—	—	—	50.3 × 67.7 × 0.1t	5	50.3 × 67.7 × 0.5t	2	50.2 × 60 × 12.2	1
111-25-11 ϕ 50/ ϕ 60	NVD07SCD082 or an equivalent	1	—	—	—	—	—	—	—	—	—	—
111-25-12 ϕ 50	NVD07SCD082 or an equivalent	1	—	—	—	—	50.3 × 67.7 × 0.1t	3	—	—	—	—
111-25-12 ϕ 60	NVD07SCD082 or an equivalent	1	—	—	—	—	60.3 × 84.7 × 0.1t	3	—	—	—	—
111-25-13	NVD07SCD082 or an equivalent	1	M12 × 22	4	M12	4	—	—	—	—	—	—

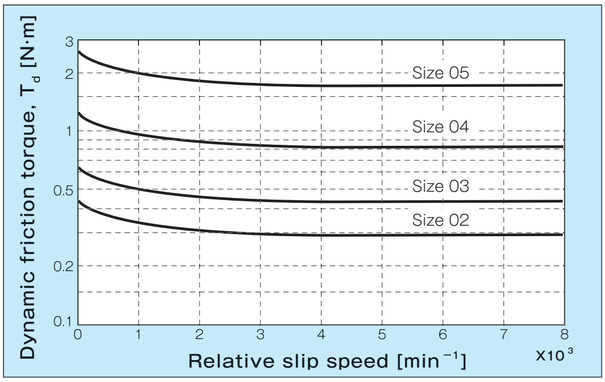
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Torque Characteristics

Static and Dynamic Friction Torque Characteristics

Clutches and brakes transmit torque as they slip at certain relative speeds in the engaging/braking process. Then, the relative speed gradually decreases until the clutch is fully engaged. The torque that can be transmitted when this engaging/braking is complete is called the dynamic friction torque at that relative speed.

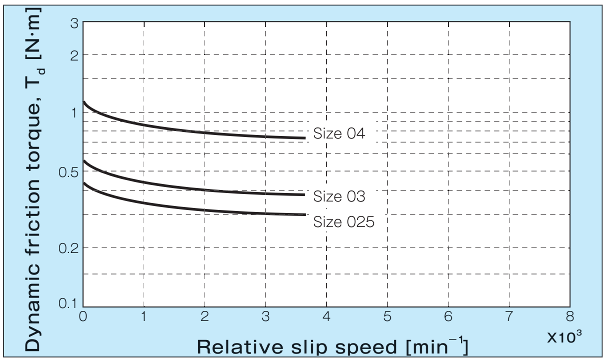
Static friction torque is a nearly predetermined value, while dynamic friction torque varies somewhat with relative speed.



Dynamic friction torque characteristics (micro size models 102 and 112)

Dynamic Friction Torque Characteristics

The figure at right shows the relationship between relative slip speed and dynamic friction torque. As the figure shows, the difference between static friction torque and dynamic friction torque is small, so the effects in actual use are diminished. Note that the specifications present the values when the relative slip speed is 100 min^{-1}.

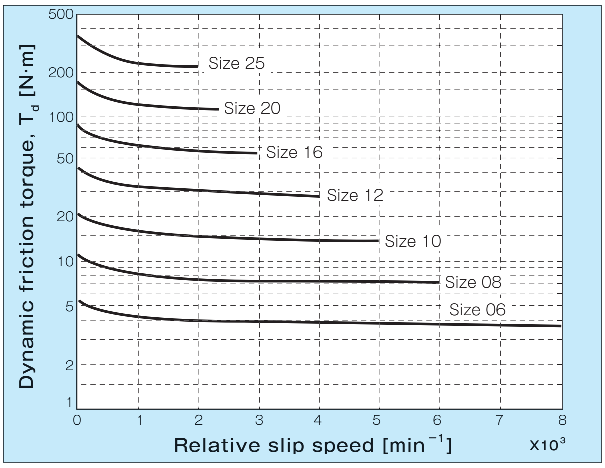


Dynamic friction torque characteristics (micro size CYT models)

Initial Torque Characteristics

The frictional surfaces of clutches and brakes that use friction will not be fully broken during initial use, so they may not always reach rated torque. This is referred to as the initial torque state. The initial torque value will be 60 to 70% of indicated torque; after a little breaking in, the indicated value will be reached. Check these values if you require the indicated torque right from the initial use. Breaking in may take longer when the equipment is used with light loads or at low speeds.

Residual torque (torque remaining after current is shut off) also exists. Due to the action of the disc spring, residual torque persists for a very short time, so special circuits for reverse excitation or the like are not necessary in normal use.



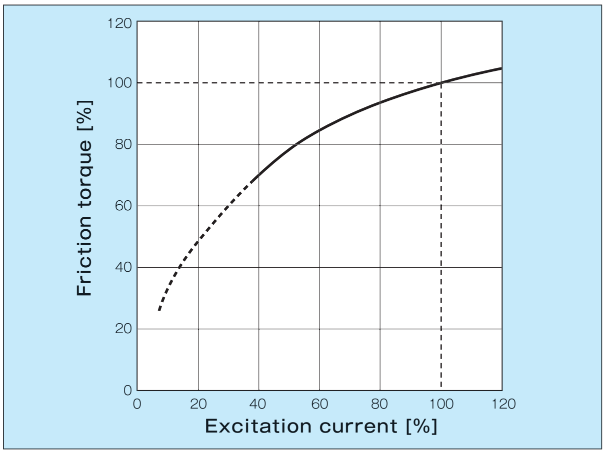
Dynamic torque characteristics (standard size models 101, 111, CS etc.)

Torque-Current Characteristics

The size of the friction torque, when the friction coefficient is μ, the average radius of the frictional surface is r, and the pull-in force is P, is given by:

$$T = \mu \times r \times P$$

Here, μ and r are predetermined, but pull-in force P varies with the size of the current supplied. Since current is proportional to voltage, friction torque changes when the voltage applied to the coil changes. The figure at right shows the relationship between friction torque and excitation current. Near the rated current value, torque increases and decreases nearly proportionally to current. As current is increased beyond the rated value, magnetic flux in the magnetic circuit reaches saturation. Further increases do not increase torque but merely increase the amount of heat generated. Conversely, as current is decreased, torque decreases. However, as the minimum current required to attract the armature is neared, torque becomes unstable; when decreased further, the armature can no longer be attracted, and torque is extinguished. (To generate torque below the armature pull-in current value, appropriate measures must be taken.) Note that this characteristics chart is at the prescribed air gap; if the air gap value changes, the characteristics curve will also change.



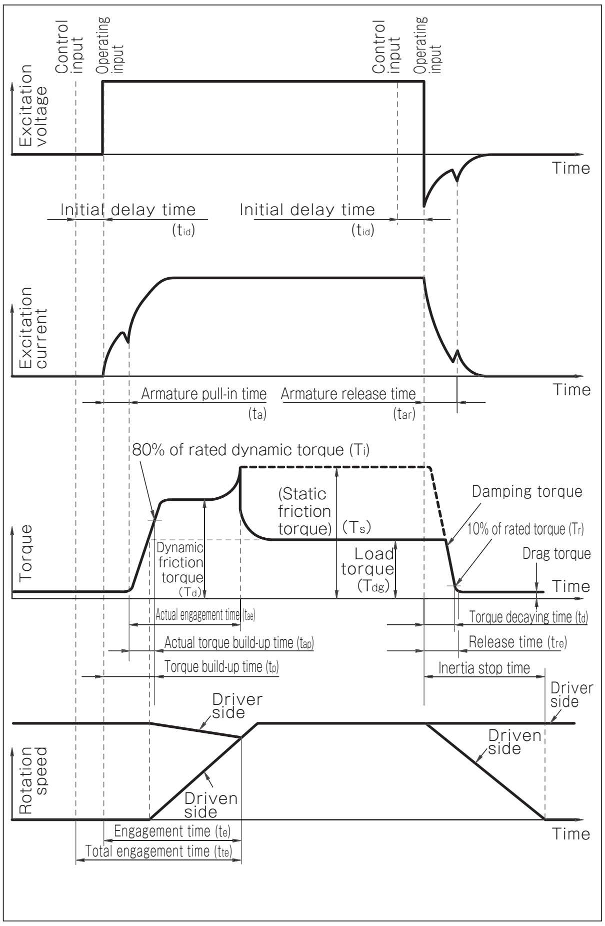
Torque-current characteristics

Operating Characteristics

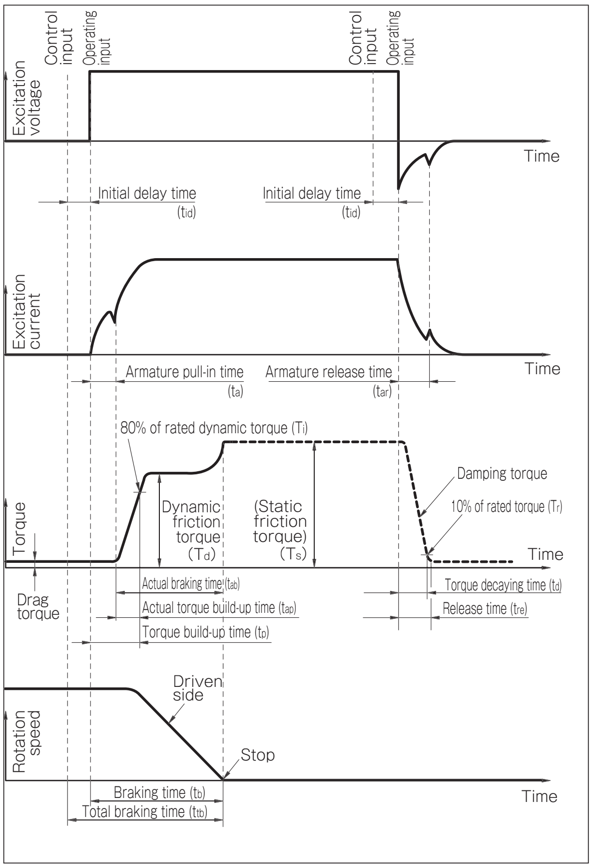
Transient Characteristics When Clutch/ Brake Are Actuated

The figure below illustrates transient phenomena of current and torque when clutches and brakes engage (brake) and release. These are generally called dynamic characteristics. When a voltage is applied to the clutch/brake, current increases according to a time constant determined by the coil. Once current has increased to a certain value, the armature is pulled in and the generation of friction torque begins. Thereafter, as current increases, friction torque also increases to reach the rated value. At the time of release, current decreases in the same way as when engaging (braking), the armature starts its withdrawal with the release action of the disc spring, and torque is extinguished.

Clutch operating characteristics



Brake operating characteristics



t_a: Armature pull-in time
(The time from when current flow first starts until the armature is pulled in and torque begins to be generated)

t_{ap}: Actual torque build-up time
(The time from when torque first begins to be generated until it reaches 80% of rated torque)

t_p: Torque build-up time
(The time from when current flow first starts until torque reaches 80% of rated torque)

t_d: Torque decaying time
(The time from when current flow is shut off until torque decreases to 10% of rated torque)

t_{id}: Initial delay time
(The time from the arrival of operational input at the clutch and brake until the actuation input or release input arrives at the clutch or brake body)

t_{ae}: Actual engagement time
(The time from when the clutch begins generating torque until engagement is complete)

t_{ab}: Actual braking time
(The time from when the brakes begins generating torque until braking is complete)

ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Operating Characteristics

Control Circuit System and Operation Times

The standard voltage is DC 24 V. If there is no DC power supply, the direct current obtained by stepping down and rectifying (full-wave rectification) the AC power supply is used. (See page on power supplies.) The clutch or brake is normally turned on or off on the DC side. The operation times in that case are shown in the table below. Performing these command operations on the DC side provides fast response, but a very large surge current is generated when the current is shut off. This surge current can burn contacts within the control circuit or damage the coil insulation. For this reason, circuit protectors are used to absorb surges.

When switching is performed on the AC side, the torque decaying time lengthens. When the torque decaying time lengthens, one clutch or brake operation may interfere with the next. Accordingly, a time lag should be designed in. The torque build-up time is the same as when the command operation is performed on the DC side.

The electromagnetic clutch/brake operation times below are values using transformer stepdown/single-phase full-wave rectification.

■ Micro sizes

Clutch operation time

Clutch size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
102-02	0.009	0.010	0.019	0.017
102-03	0.009	0.013	0.022	0.020
102-04	0.011	0.017	0.028	0.030
102-05	0.012	0.019	0.031	0.040
CYT-025	0.014	0.014	0.028	0.030
CYT-03	0.015	0.015	0.030	0.040
CYT-04	0.030	0.010	0.040	0.040

Brake operating time

Brake size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
112-02	0.004	0.006	0.010	0.010
112-03	0.005	0.007	0.012	0.008
112-04	0.007	0.009	0.016	0.010
112-05	0.010	0.013	0.023	0.012

■ Standard sizes

Clutch operation time

Clutch size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
101-06	0.020	0.021	0.041	0.020
101-08	0.023	0.028	0.051	0.030
101-10	0.025	0.038	0.063	0.050
101-12	0.040	0.075	0.115	0.065
101-16	0.050	0.110	0.160	0.085
101-20	0.090	0.160	0.250	0.130
101-25	0.115	0.220	0.335	0.210

* The above values are suitable for CS and CSZ models as well as for the various clutch/brake unit models.

Brake operating time

Brake size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
111-06	0.015	0.018	0.033	0.015
111-08	0.016	0.026	0.042	0.025
111-10	0.018	0.038	0.056	0.030
111-12	0.027	0.063	0.090	0.050
111-16	0.035	0.092	0.127	0.055
111-20	0.065	0.135	0.200	0.070
111-25	0.085	0.190	0.275	0.125

* The above values are suitable for BSZ models as well as for the various clutch/brake unit models.

To Shorten the Engagement/Braking Time

Current obeys a predetermined time constant, but when a particularly fast build-up time is required, the operation characteristics can be changed by using an excitation method, such as overexcitation. The overexcitation method applies an overvoltage to the coil to speed up the rise. Operation times in the case of overexcitation are shown in the table below.

For details, refer to the section on power supplies.

Operation times for overexcitation of clutch (using a BEH power supply)

Clutch size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
101-06	0.008	0.005	0.013	0.005
101-08	0.009	0.008	0.017	0.008
101-10	0.010	0.010	0.020	0.011
101-12	0.013	0.012	0.025	0.018
101-16	0.018	0.016	0.034	0.023
101-20	0.027	0.020	0.047	0.037
101-25	0.045	0.026	0.071	0.045

* The above values are suitable for CS and CSZ models as well as for the various clutch/brake unit models.

Operation times for overexcitation of brake (using a BEH power supply)

Brake size	Operating time [s]			
	t_a	t_{ap}	t_p	t_d
111-06	0.005	0.007	0.012	0.004
111-08	0.005	0.007	0.012	0.005
111-10	0.007	0.008	0.015	0.007
111-12	0.009	0.009	0.018	0.007
111-16	0.014	0.010	0.024	0.011
111-20	0.015	0.025	0.040	0.020
111-25	0.021	0.034	0.055	0.038

* The above values are suitable for BSZ models as well as for the various clutch/brake unit models.

t_a Armature pull-in time: The time from when current flow first starts until the armature is pulled in and torque begins to be generated.

t_{ap} Actual torque build-up time: The time from when torque first begins to be generated until it reaches 80% of rated torque.

t_p Torque build-up time: The time from when current flow first starts until torque reaches 80% of rated torque.

t_d Torque decaying time: The time from when current flow is shut off until torque decreases to 10% of rated torque.

Limit on Number of Operations

There are some limits for command operations that turn clutches and brakes on and off per unit time. Due to their size, micro sizes are particularly prone to being unable to externally dissipate heat at some energization frequencies, and may malfunction or be damaged. That limit is expressed as an energization rate. For that limit, being energized for 0.5 seconds over a one second period is treated as 50%. Operations must be designed so that the energization rate does not exceed the following rates shown for each model. These limits may not apply, however, if the clutch or brake is effectively cooled.

Models	Energization rate
102 Models	80%
CYT Models	50%
112 Models	80%
101/CS Models	100%
CSZ Models	100%
111 Models	100%
BSZ Models	100%

Furthermore, in the case of overexcitation intended to speed up the build-up by applying overvoltage to the coil, a voltage higher than the normal excitation voltage is applied, so care is required even with standard sizes. Ascertain your operating conditions and the like and then check these issues for your particular situation.

Heat Radiation Characteristics

Allowable Energy ($E_{ea\ell}$ or $E_{ba\ell}$)

When loads are accelerated or decelerated by a clutch/brake, heat will be generated by sliding friction. This is because frictional energy is converted to heat, so the amount of heat will vary with the conditions of use.

Clutches and brakes dissipate this heat externally as they work, but if they cannot dissipate all the heat, they accumulate it internally and the temperatures of the components rise. If temperatures exceed allowable values, malfunctions and damage result.

The limit for friction work undergone due to this heat is called allowable energy. The allowable energy is predetermined for each size. Heat dissipation is affected by the mounting situation, rotation speed, atmosphere, and the like.

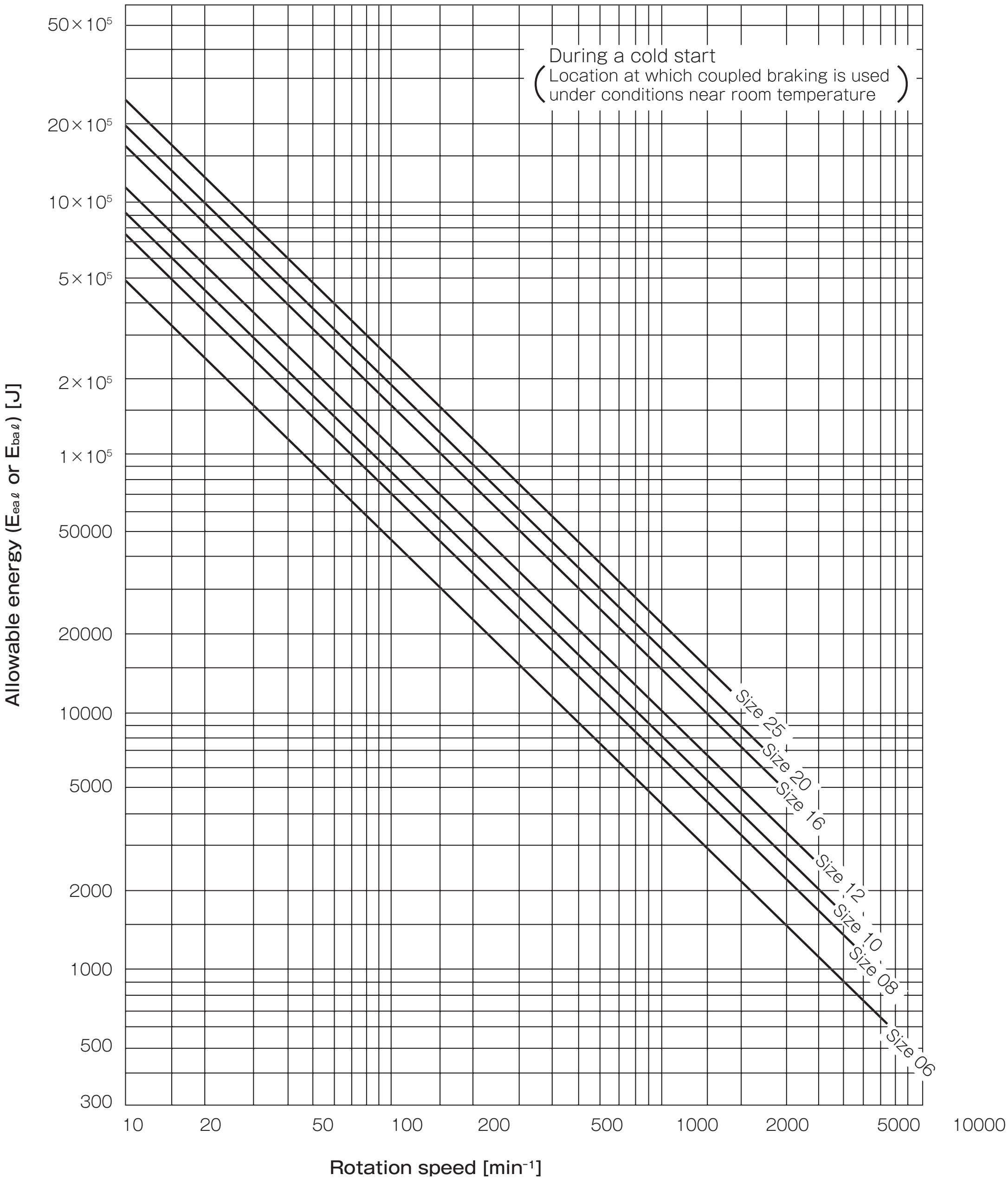
When large loads are accelerated or decelerated, violent slipping occurs, and the frictional surface generates larges amounts of heat. The frictional material and armature can be damaged by even a single engagement.

The table at right shows the allowable energy (allowable friction energy) for each size of micro clutches and micro brakes. Even if frequency is low, use the device at a value that is sufficiently smaller than the table value if you have a single engagement whose amount of energy is high.

Use standard sizes below the limit lines of the figure below.

Allowable energy of micro clutches and micro brakes

Model size	Allowable (engagement/braking) energy ($E_{ea\ell}$ or $E_{ba\ell}$) [J]
102/112-02	1500
102/112-03	2300
102/112-04	4500
102/112-05	9000
CYT-025	800
CYT-03	900
CYT-04	1900



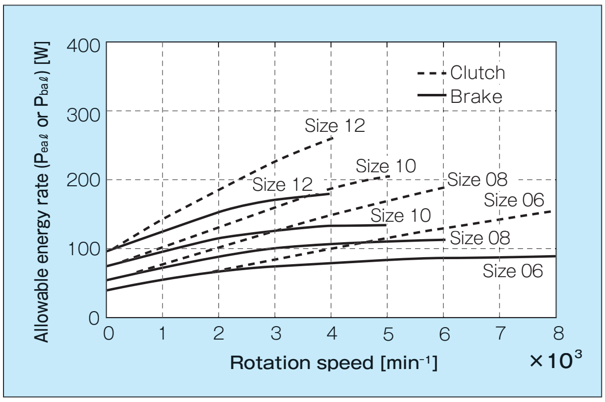
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Heat Radiation Characteristics

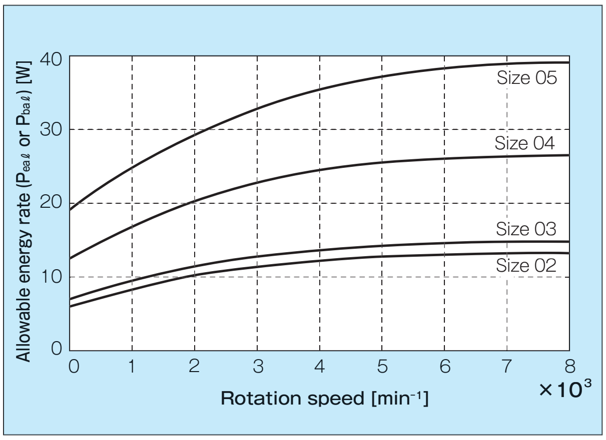
Allowable Energy Rate ($P_{ea\ell}$ or $P_{ba\ell}$)

High frequency of engagement and/or braking must take heat dissipation fully into account. The maximum energy amount per unit time is called the allowable energy rate. It is predetermined for each size as shown in the figure. In actual use, use a value that is sufficiently smaller than the allowable value to allow for changes in conditions and the like.

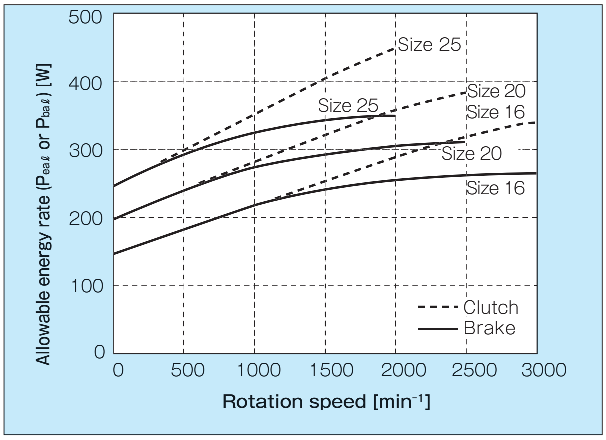
The figure shows values for wall-mounted devices. For devices mounted on shafts such as bearing-mounted models, use 80% of the allowable values in the figures.



Standard sizes



Micro sizes (excludes CYT models)



Standard sizes

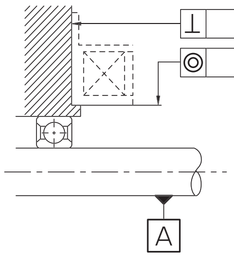
Items Checked for Design Purposes

What is the best way to ensure that the design allows clutches and brakes used in machinery and equipment to perform and function adequately? We describe here approaches to design that we feel are useful in improving machinery reliability.

Mounting Stators and Rotors

Flange-mounted stators (models □-□-1□)

These stators must be correctly positioned with respect to the rotation shaft before mounting. The inner and outer circumferences of the stators have grades for fit. The surface on which the stator is mounted should be positioned relative to the rotation shaft and the allowable values for concentricity and perpendicularity of the diameter should not be exceeded.

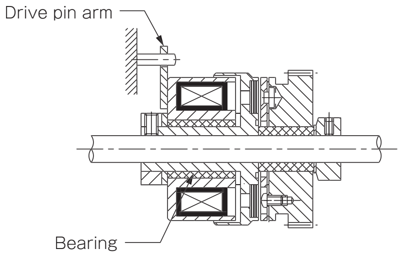


Unit [mm]

Size	Concentricity (T.I.R.)	Perpendicularity (T.I.R.)
02	0.05	0.03
03	0.05	0.04
04	0.06	0.04
05	0.06	0.05
06	0.08	0.05
08	0.08	0.05
10	0.1	0.05
12	0.1	0.07
16	0.12	0.08
20	0.12	0.13
25	0.14	0.13

Bearing-mounted stators (models □-□-3□)

This stator is subject to a slight amount of rotation force from the built-in bearing or the slide bearing. The drive pin arm should therefore be held to the machinery's stationary parts to prevent drag turning.



Magnetic shield of stator

Installing clutches and brakes in combination can lead to instability of clutch/brake operation due to their magnetic effects on each other. Also, if there are instruments or machinery in the vicinity of the clutch or brake, adverse effects such as noise or malfunction may result.

In such cases, measures to block magnetism are advised. The method generally used is to adopt non-magnetic materials for the surface on which the stator is mounted and for the shaft.

Lead wire protection

Damage to the covering of the leads can cause shorts, breaks or other problems. Keep protection of these coverings in mind from the design stage.

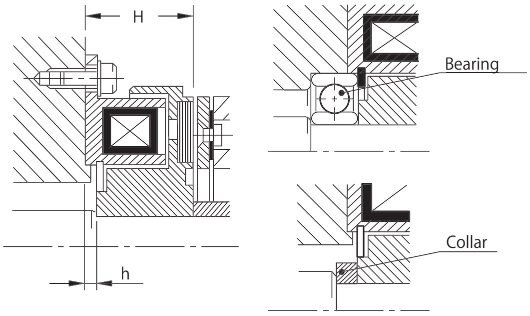
Rotor mounting

The rotor is part of the magnetic circuit. Machining other than bore drilling can lower performance, so it should be avoided.

Consult Miki Pulley if you are creating a rotor bore with a non-standard diameter not shown in the dimensions table.

Relationship between rotor and stator (models □-□-1□)

In flange-mounted clutches, the positional relationship between rotor and stator is important. If the dimension H in the figure below is too small, the rotor and stator will touch; if H is too large, the pull-in force will decline. The table below lists allowable values for each size. Design your setup so that these values are not exceeded. The allowable value for h should conform to the normal JIS allowable value.



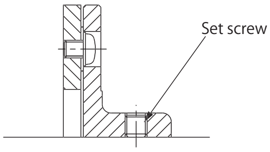
Unit [mm]

Clutch size	H		h
	Reference value	Tolerance	Reference value
102-02	18.0	± 0.2	1.6
102-03	22.2	± 0.2	2.0
102-04	25.4	± 0.2	2.0
102-05	28.1	± 0.2	2.0
101-06	24.0	± 0.2	2.0
101-08	26.5	± 0.2	2.5
101-10	30.0	± 0.3	3.0
101-12	33.5	± 0.3	3.5
101-16	37.5	± 0.3	3.5
101-20	44.0	± 0.4	4.0
101-25	51.0	± 0.4	4.0

Armature Mounting Methods

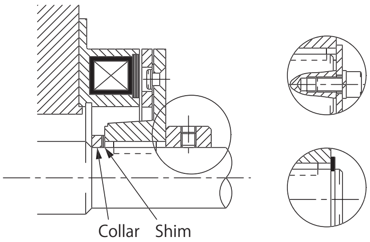
Mounting armature type-1

Securely fasten the armature with the provided hex-socket-head set screw. If you are concerned that it might be loosened by vibration or high-frequency operations, apply adhesive to the threads, which is effective in stopping loosening.



Mounting armature type-2

Since the boss is hidden on the inside of the stator, secure it firmly using a C-shaped snap ring, collar, or the like, as shown in the figure below.



Mounting armature type-5

For size 05 and smaller micro sizes, insert the armature directly onto the shaft. As when assembling armature type-2, firmly press the end face of the armature with a C-shaped snap ring, collar or the like.

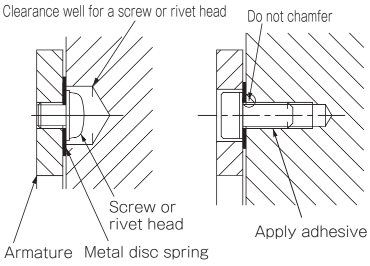
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

■ Armature type-3 mounting

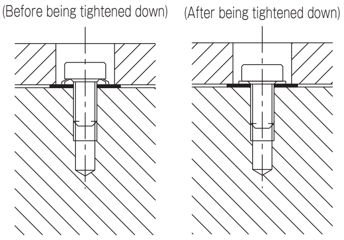
Machine in the screw bores and clearance well for screw and/or rivet heads in the mounting surface. Mount the armature using the supplied special hex-socket-head bolts and disc spring washers, applying a small amount of adhesive to the threads to prevent loosening. (Note that any excess adhesive will seep into the disc spring, impeding operation.)
The mounting screw bores should not be beveled; simply removing burr is sufficient. The hex-socket-head bolts supplied are special low-head bolts. For sizes 04 and smaller, Phillips-head round head screws that meet JIS standards are supplied. Use disc spring washers like that depicted in the figure below. Their fastening effect is diminished if used facing backwards.
Assemble armature type-3 correctly so that the concentricity and perpendicularity relative to the rotation shaft do not exceed the allowable values.

Unit [mm]

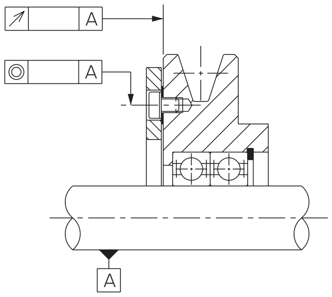
Size	Concentricity (T.I.R.)	Perpendicularity (T.I.R.)
02	0.1	0.02
03	0.1	0.03
04	0.1	0.04
05	0.1	0.04
06	0.16	0.04
08	0.16	0.05
10	0.16	0.05
12	0.16	0.06
16	0.16	0.07
20	0.24	0.11
25	0.24	0.11



Armature type-3 mounting

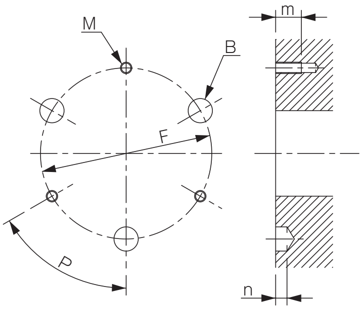


How to use washers



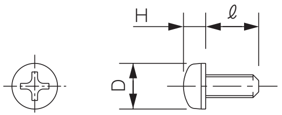
Mounting precision

Armature type-3 mounting dimensions

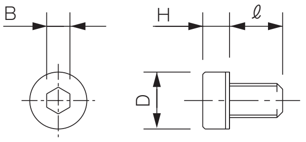


Clutch/ brake size	Mounting pitch diameter		Mounting angle		Mounting screw bore			Clearance well for screw/rivet head	
	F (P.C.D.)	Tolerance	P [°]	Tolerance [′]	No. of bores-M (nominal)	Pitch	Effective thread depth m (MIN)	No. of bores-Bore diameter B	Spot facing depth n (MIN)
02	19.5	±0.05	90	±5	2-M2	0.4	4	2-5	2.5
03	23	±0.05	60	±5	3-M2.5	0.45	5	3-6	3
04	30	±0.05	60	±5	3-M3	0.5	7	3-6	3.5
05	38	±0.05	60	±5	3-M3	0.5	7	3-7	3.5
06	46	±0.05	60	±5	3-M3	0.5	7	3-7	3.5
08	60	±0.05	60	±5	3-M4	0.7	9	3-8.5	3.5
10	76	±0.05	60	±5	3-M5	0.8	11	3-10.5	4
12	95	±0.05	60	±5	3-M6	1.0	11	3-12.5	4
16	120	±0.05	60	±5	3-M8	1.25	16	3-15.5	4.5
20	158	±0.05	60	±5	3-M10	1.5	18	3-19	5.5
25	210	±0.1	45	±5	4-M12	1.75	22	4-22	6

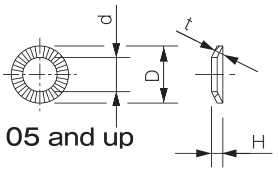
Armature type-3 mounting components



Size 02 to 04



Size 05 and up



Size 05 and up

Clutch/ brake size	Special hex-socket-head bolt (* Phillips-head round head screw)					Disc spring washer			
	Nominal × pitch	ϕD	H	B	ℓ	ϕD	ϕd	H	t
02	* M2 × 0.4	3.5	1.3	—	3	—	—	—	—
03	* M2.5 × 0.45	4.5	1.7	—	4	—	—	—	—
04	* M3 × 0.5	5.5	2.0	—	6	—	—	—	—
05	M3 × 0.5	5.5	2.0	2.0	6	6	3.2	0.55	0.36
06	M3 × 0.5	5.5	2.0	2.0	6	6	3.2	0.55	0.36
08	M4 × 0.7	7	2.8	2.5	8	7	4.25	0.7	0.5
10	M5 × 0.8	8.5	3.5	3.0	10	8.5	5.25	0.85	0.6
12	M6 × 1.0	10	4.0	4.0	10	10	6.4	1.0	0.7
16	M8 × 1.25	13	5.0	5.0	15	13	8.4	1.2	0.8
20	M10 × 1.5	16	6.0	6.0	18	16	10.6	1.9	1.5
25	M12 × 1.75	18	7.0	8.0	22	18	12.6	2.2	1.8

* Sizes 02, 03, and 04 do not use disc spring washers.

Air Gap Design and Adjustment

Set the air gap "a" (below figure) between the frictional surfaces so that when released the gap becomes the control value. Handling will be easier if the device is designed to facilitate this adjustment.

We recommend designs with both collars and shims as shown below to accomplish this. (We always have shims available; please contact Miki Pulley for details.)

■ Setting air gap "a"

Prepare a collar that is slightly shorter than the length ℓ needed to maintain air gap "a", and then adjust the remaining gap with shims to achieve the control value for "a". The collar length at this time is roughly the value given by the following equation.

$$L \fallingdotseq \ell - 2a \text{ [mm]}$$

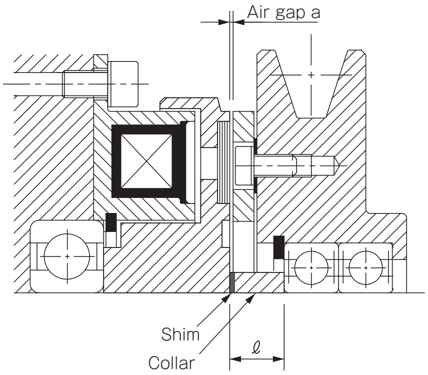
Here, L: Collar length.

ℓ : Length required to maintain air gap "a"

a: Control air gap value

Based on the value of L found with this equation, prepare a collar of a length that is easy to machine. Using a design like this that employs shims will enable you to adjust the air gap after long periods of use by simply removing the necessary number of shims.

Air gap setting



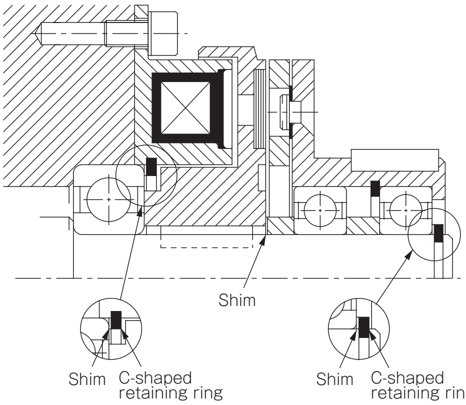
* Use the section on technical documentation to check the shim dimensions.

■ Eliminating axial play

If there is any axial play between the clutch or brake and the components used in combination with it after assembly, the performance of the clutch or brake could be impaired. Design to keep play extremely small. Many types of shims are available for keeping the axial play to a very slight amount. They match the shaft diameters and bearing outer diameters dimensions used most.

If C-shaped retaining rings are also used, a secure lock can be achieved while preserving the spring effect of the retaining ring.

How to use shims

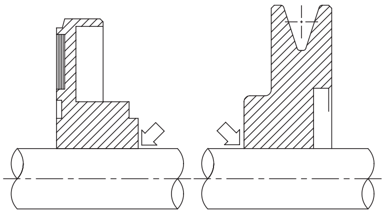


Fitting Tolerances

Clutches and brakes must be able to do large amounts of work instantly while also performing precise control. That means that the precision of all components must be appropriately unified so they do not cause wear or generate vibration. Fitting tolerances (grades) must also be determined so that they match the conditions of use.

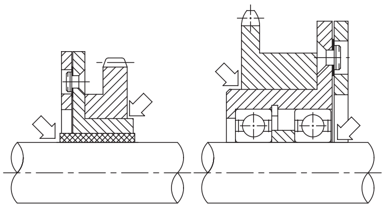
■ Fitting tolerance for rotor, armatures type-1 and type-2, V pulley, and shaft

The reference bore tolerance is H7 class. CYT models, however, have a special bore diameter tolerance (shown in the dimensions table). The table below shows dimensional tolerances for the shaft to be used.



Load conditions	Shaft tolerance		Remark
Shaft with ø10 or below	h6	h7	h5 if accuracy is required
Light/normal loads and fluctuating loads	h6		For motor shaft, h6 or j6 For clutch/brake unit shafts, j6
	js6	js7	
	j6	j7	
Heavy loads and shock loads	k6	k7	
	m6		

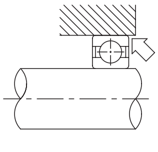
■ Fitting tolerances for armature type-5 and sprockets, or the like, and for armature type-5 and shafts



Micro size Standard size

Clutch/brake size	Armature type-5		Bore tolerance for sprockets, etc.	Shaft tolerance
	Boss tolerance	Bore tolerance		
02 ～ 05	h7	H7	H7	h7 h8
06 or over	j6	As given in table below	H7	As given in table above

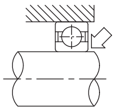
■ Tolerances for fitting ball bearing to housings

Load conditions		Bore tolerance	Remark
Rotating outer ring load	Heavy loads	N7	
	Normal load and fluctuating loads	M7	
Directionally unstable loads	Heavy shock loads		
	Heavy loads and normal loads	K7	
	Normal loads and light loads	J7	
Rotating inner ring load	Shock loads		
	Ordinary loads	H7	When clutch/brake is not subject to shock

* Applicable to steel or iron housings. For light alloy housings, the fit must be stiffer.

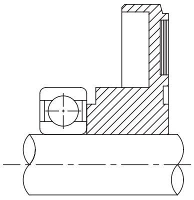
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

■ Tolerances for fitting ball bearings to shafts

Load conditions		Bore tolerance		Remark
Rotating outer ring load		h6		When precision is required, h5
Dimensionally unstable loads and rotating inner ring loads	Light loads, normal loads and fluctuating loads	ø18 or below	h5	
		ø100 or below	j6	
	Heavy loads and shock loads	ø18 or below	j5	
		ø100 or below	k5	

■ Fitting tolerances for bearings and other components

If bearings are mounted on the same part of the shaft as rotors, V pulleys or other components, give priority to the bearing when determining the grade of the shaft by using the tolerance for fitting ball bearings to shafts.



Bore Diameters and Keyways

■ Bore diameters

Standard bore diameters are determined for each size (shown in the dimensions table) and available for selection. If you wish to use a non-standard bore diameter, pilot bores are provided on 101 and 111 type rotors and armatures type-1 and type-2. Adhere to the drilling ranges and cautions noted below. The ranges of bore diameters that can be drilled are shown in the table below.

- Make the fitting tolerance of the bore H7 class.
- Pay sufficient attention to concentricity and perpendicularity when drilling bores.
- The outer circumference of the rotor can become misshapen if force is applied, so do not chuck it.
- Completely remove all cutting oil, cleaning oil, and the like from the bore and dry it before mounting the piece on machinery.

■ Keys and keyways

Keyways of rotors and armatures are made to Miki Pulley standards, which are based on JIS standards. (See the page on standard bore drilling standards for clutches and brakes.) CYT models, however, use special keyway tolerances (shown in the dimensions table).

Use JIS standard keys and keyways on the shafts to be used. (Refer to the pages on technical documentation extracted from JIS B 1301-1996) Follow this standard also for rotor and armature hub.

Bore diameter processing ranges for rotors, armature type-1, and armature type-2.

Unit [mm]

Clutch/brake size		Bore diameter																						
		5	6	8	(8.5)	10	12	(12.5)	15	17	(18.5)	20	(24)	25	28	30	32	35	40	48	50	60	70	75
02	Rotor [R]	●																						
	Armature [A]	●																						
03	Rotor [R]		●																					
	Armature [A]		●																					
04	Rotor [R]			●		●																		
	Armature [A]			●		●																		
05	Rotor [R]					●			●															
	Armature [A]					●			●															
06	Rotor [R]				▨	▨	●	▨	●	▨														
	Armature [A]				▨	▨	●	▨	●	▨														
08	Rotor [R]				▨	▨	▨	▨	●	▨	▨	●	▨											
	Armature [A]				▨	▨	▨	▨	●	▨	▨	●	▨											
10	Rotor [R]							▨	▨	▨	▨	●	▨	●	▨									
	Armature [A]							▨	▨	▨	▨	●	▨	●	▨									
12	Rotor [R]							▨	▨	▨	▨	▨	▨	●	▨	●	▨	▨						
	Armature [A]							▨	▨	▨	▨	▨	▨	●	▨	●	▨							
16	Rotor [R]										▨	▨	▨	▨	▨	●	▨	▨	●	▨	▨			
	Armature [A]										▨	▨	▨	▨	▨	●	▨	▨	●	▨				
20	Rotor [R]												▨	▨	▨	▨	▨	▨	●	▨	●	▨		
	Armature [A]												▨	▨	▨	▨	▨	▨	●	▨	●	▨		
25	Rotor [R]												▨	▨	▨	▨	▨	▨	▨	▨	●	●	▨	▨
	Armature [A]												▨	▨	▨	▨	▨	▨	▨	▨	●	●	▨	▨

* The ● mark indicates a standard bore diameter. ▨ is the range of bore diameters that can be drilled in products with pilot bores.
* If a bore diameter is given in parentheses, the bore is a pilot bore. (The final bore has not been drilled.)
* The above table does not apply to CYT, CS, CSZ, and BSZ models.

Environment for Mounting Parts

Take the environment where the clutch or brake will be used into account in your design.

■ Temperature

Clutches and brakes are heat resistance class B. Their operating temperature range is -10 to 40°C. If used at higher temperatures, heat generated by actual engagement and braking work cannot be dissipated and the coil and/or frictional parts may be damaged. The devices may be used at temperatures below -10°C if the heat generated by the clutch or brake keeps the devices at -10°C or above. However, moisture may adhere through condensation if stationary for longer periods of time or if used at low frequency, potentially leading to decreased performance. Use in extreme environments of -20°C and below may lead to problems. Consult Miki Pulley for details.

■ Humidity and dripping

As with temperature, water droplets adhering to the frictional surfaces will temporarily decrease frictional force until the surface dries, so place a cover on the equipment or otherwise protect it. The adherence of moisture can cause rust.

■ Infiltration of dust, oils, and other foreign matter

The infiltration of foreign matter into the frictional surface is undesirable. Infiltration of oils markedly degrades frictional force. Dust, especially if it contains metal particles, can cause problems by damaging the frictional surface and rotating parts. Chemical infiltration can cause corrosion, in addition to the rust described above.
In such environments, consider the use of a protective cover.

■ Ventilation

Since clutches and brakes convert frictional energy into heat and dissipate it externally, it is preferable to install them in well ventilated locations. Forced air cooling (with a fan or the like) can be used effectively to increase the allowable energy. If you are using the equipment in a poorly ventilated location, consider temperatures carefully.

Max. Rotation Speed

The max. rotation speeds of clutches and brakes are shown in the specifications table. This value is determined by the circumferential speed of the frictional surface, so when used beyond the max. rotation speed, not only will the indicated torque not be generated, abnormal wear, heat damage, and the like may occur.

Ball Bearings

Ball bearings are widely used in combination with clutches and brakes, with deep groove ball bearings the most widely used among them.
Since it is undesirable to get oils on the frictional surfaces of dry-style clutches and brakes, use double-sealed bearings that do not require the addition of oil. Non-contact style double-sealed bearings that use rubber seals not only do not require the addition of oil, they are also excellent at keeping out dust. Metal double-sealed bearings can also be used for compact bearings and some hard-to-obtain bearings.

Mechanical Strength of Components

Clutches and brakes have excellent operational characteristics, so they are able to instantly engage or brake loads. For that reason, machinery components may experience impact forces. Be sure to build sufficient strength into your design. (Note that an overly safe design may increase load torque or affect the precision of engagement/braking.)

Vibration and Rattle

The structural components of clutches and brakes are adequately balanced so vibration does not occur. Mounting rattle can occur, however, after repeated shocks, and that can produce vibration noise. Use a design without rattle.

Corrosion Prevention

Clutches and brakes are treated to prevent corrosion, but rust may occur if storage conditions are poor or if the device is used in certain environments. Moderate rust does not present a problem for use, but we advise that you care for the equipment so that it does not rust.

Sparking

Sparks may be produced during clutch or brake use. This is because of friction between the armature and the magnetic part of the frictional surface. Adequate checks are required when using this equipment in volatile atmospheres.

Designing for Maintenance

Clutches and brakes require virtually nothing in the way of maintenance over the long term.
However, you can get even longer use out of them by proper maintenance of the air gap of the frictional parts and the ball bearings used. We recommend that you design structures so they can be easily disassembled and reassembled.
For details, refer to the operating manual.

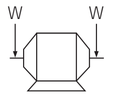
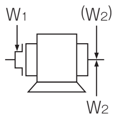
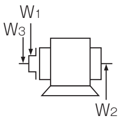
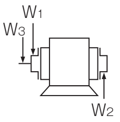
Use of Micro Clutches

When using bearing-mounted micro clutches (in which the bearings are oil-impregnated metal), energization rate, temperature and the like may sometimes be restricted. Consult Miki Pulley for details.

Overhang Load of Unit

The table below shows the allowable values for radial load that can be applied to the shaft of the unit. Allowable values will vary somewhat on through-shaft model units due to the directions in which input and output loads act. (The values shown are for the most demanding conditions. The load point is the center point of the shaft.)

Unit [N]

Size	125-□-12 126-□-4B	121-□-20G		121-□-10G 122-□-20G
				
05	250	–	–	–
06	320	300 (320)	140	140
08	480	450 (500)	250	250
10	700	700 (800)	450	450
12	900	900 (1000)	700	700
16	1300	1400 (1600)	1000	1000
20	1800	2000 (2500)	1800	1800
25	–	2900 (3600)	2600	2600

* Numbers in parentheses are for loads in the same direction.

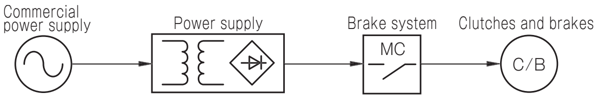
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES

Control Circuits

Basic Structure of Electrical Circuits

When designing the electrical circuitry that controls clutches and brakes, the selection of the control method and control equipment is very important. The correct selection of these and designing the circuit both stabilize the operating characteristics of clutches and brakes and increase the reliability of machinery.

A DC 24 V (standard specification) power supply is needed to operate clutches and brakes. For this, either a DC power supply can be used, or an AC power supply can be stepped down and rectified. We have a variety of power supply devices dedicated for clutches and brakes available. For details, refer to the page on power supplies.



Standard wiring

Selecting Components for Power Supplies

Transformers

Match the primary side to the supply voltage. On the secondary side, use something with sufficient capacity to be able to apply the rated voltage to the clutch (brake) coil.

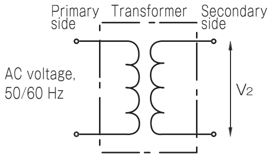
As a guideline, select a transformer that has a capacity 1.25 times the rated capacity of the clutch (brake) at 20° C. Note that the secondary-side output voltage must be set according to the rectifier's voltage drop or the transformer's impedance drop. These can be found in simplified terms, from Eqs. (1) and (2) below.

$$V_2 = \frac{V + 1.4}{0.9}\ [V] \cdots\cdots (1)$$

Eq. (1) is from the single-phase full-wave rectification system.

$$P \geqq W_{CB} \times 1.25\ [VA] \quad (2)$$

V₂: Transformer secondary voltage [V]
V: DC voltage [V]
P: Transformer capacity [VA]
W_{CB}: Clutch (brake) capacity [VA]



Rectifiers

There are several different rectification systems. Miki Pulley uses single-phase full-wave rectification (the bridge system). For a system to be selected, the maximum rated value of the rectifier must not be exceeded. The rated maximum can be found in simplified terms using the following Eq. (3).

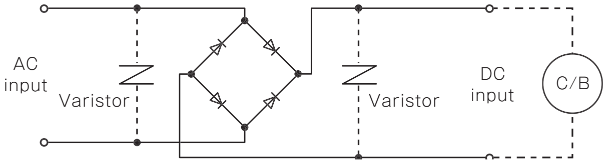
- Determining withstand voltage V_{RM} in the reverse direction

$$V_{RM} = V_L \cdot \sqrt{2} \cdot K \cdots\cdots (3)$$

V_L: AC input voltage [V]
K: Safety factor (make the factor between 2 and 3)

Note that if a surge voltage at or above the withstand voltage may find its way in from outside, the rectifier must be protected.

- Determining the average rectification current
  Select a rectifier that has an average rectification current value of 1.5 or more times the rated current of the clutch (or brake) used. Note that when large currents flow, temperature rise becomes a problem. Take measures to give the device a heat dissipation effect and to suppress extreme temperature rises.



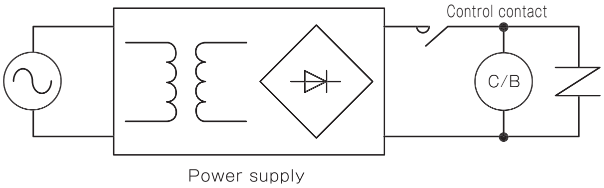
Single-phase full-wave rectified

Relays (control contacts)

Since electromagnetic clutches and brakes have internal electromagnetic coils, they must be used under the conditions of the DC inductive load of the relay you will use.

This is because contacts are heavily worn by surge voltage generated during electromagnetic clutch or brake control.

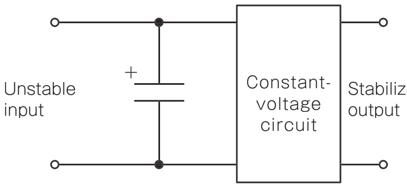
If relay service life, operational frequency, and the like are problems in use, the design must be contactless. For details, see the page on controlling electromagnetic clutches and brakes using power supplies.



DC switching

Points to note on control circuit structure

- Control of clutches and brakes
  When controlling the clutch or brake on the AC side, armature release time lengthens and high-frequency operation becomes impossible. Install control contacts on the DC side.
- Voltage supplied to the clutch or brake
  When designing a power supply circuit, keep fluctuation of the excitation voltage to within ± 10% of the rated voltage of the clutch or brake.
- Smoothing of excitation voltage
  Normally, the power supply for the clutch or brake is a single-phase full-wave rectifier. When high precision is required, however, better results are obtained by smoothing.



Stabilized power supply circuit

- Protection of control contacts
  If a protective circuit is placed in the clutch/brake, the control contacts will be protected, but the protective effect will be greater if CR absorbers are used between contacts, as shown in the figure. C (capacitor) and R (resistor) are roughly as follows.
  Capacitor C [μ F]: Ratio to contact current is:

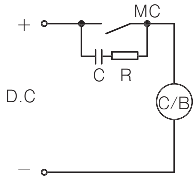
$$\frac{C\,[\mu F]}{I\,[A]} = \frac{0.5 \text{ to } 1}{1}$$

Withstand voltage: 600 [V]

Resistance R[Ω]: Ratio to contact voltage is:

$$\frac{R\,[\Omega]}{E\,[V]} \pm 1$$

Capacity = 1 [W]



Relay protector circuit

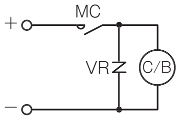
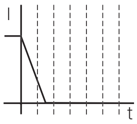
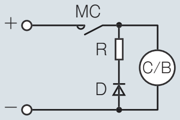
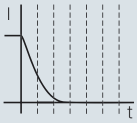
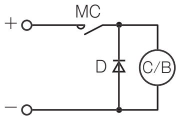
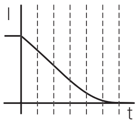
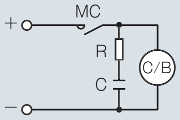
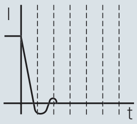
COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA
SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES

■ Discharge circuits

When a DC excitation current flows in an electromagnetic clutch or brake, energy accumulates in the coil. If current is then shut off, a surge voltage is generated between the coil terminals by the accumulated energy. This surge voltage may reach 1000 V or more depending on the shutoff speed, shutoff current, and other factors, so it can cause damage to the coil insulation, burn the contacts in switches, and more. Appropriate discharge circuits must therefore be installed to prevent such problems.

Different types of discharge circuits have differing armature discharge times and effectiveness in suppressing surge voltages. The table below shows the characteristics of some discharge circuits.

While different discharge circuits have many advantages and disadvantages, the type we recommend are varistors.

	Circuit diagram	Current decay	Characteristics
Varistor			Very effective in keeping surge voltage small without adding delay to the armature release time.
Resistors + diodes			Can lower power consumption in the power supply part and reduce resistor capacity. The armature release time becomes somewhat longer, so care is required in high frequency use.
Diodes			Good at suppressing surge voltage, but armature release is delayed, so clutch and brake are more prone to interfere with each other, making diodes unsuitable for high frequency use.
Resistors + capacitors			Have a short armature release time, but require capacitors with high pressure resistance.

Commercial Power Supply Specifications

Model	Rectification method	Frequency [Hz]	AC input voltage AC [V]	DC output voltage DC [V]	Wattage [W]	Applicable clutch/ brake size
BES-20-05	Single-phase, full-wave	50/60	200	24	50	02 ～ 05
BES-20-10	Single-phase, full-wave	50/60	200	24	50	06 ～ 10
BES-20-16	Single-phase, full-wave	50/60	200	24	50	12 ～ 16
BES-20-20	Single-phase, full-wave	50/60	200	24	50	20
BES-40-25	Single-phase, full-wave	50/60	200	24	100	25
BES-20-05-1	Single-phase, full-wave	50/60	100	24	50	02 ～ 05
BES-20-10-1	Single-phase, full-wave	50/60	100	24	50	06 ～ 10
BES-20-16-1	Single-phase, full-wave	50/60	100	24	50	12 ～ 16
BES-20-20-1	Single-phase, full-wave	50/60	100	24	50	20
BES-40-25-1	Single-phase, full-wave	50/60	100	24	100	25

SPRING-ACTUATED BRAKES

Application	Motors, articulated robots, actuators, machine tools, forklifts, aerial vehicles, hoists, electric carts, electric shutters, medical equipment, wind turbine generators

Provides Excellent Performance in Emergency Braking When Power Goes Out and in Long-term Holding

These are electromagnetic brakes actuated by the force of springs when not energized. These standard brakes boast a variety of advantages, including quiet operation, long service life, slim form factors, high torque in a compact package, stable braking force, and the ability to release manually. We can create custom designs for you based on these standard products.

Available Models

Series	Application	Features	Lineup
SPRING-ACTUATED BRAKE	Holding use	Compact, dual side mounting	**BXW-S**
		For compact servo motors	**BXW-R**
		Compact, controller set	**BXR-LE**
		Double plate, slim form factor	**BXR**
	Braking use	Compact, dual side mounting	**BXW-L**
		Double plate	**BXL**
		Double plate	**BXL-N**
	Holding and braking use	Compact, dual side mounting	**BXW-H**
		Double plate	**BXH**

For details on selection, see P.356 to 361.

Model Selection

Models/ Type	Mounting method	Torque [N·m] 0.1 1 10 100 1000	Release lever	Dust cover	Slim	Quiet mechanism		
						Reduced aperiodic noise	Reduced armature pull-in noise	Reduced braking noise
BXW-L/H/S	Stator/ flange	0.12 ～ 5.20	Option	Option	Customization	Std.	Customization	Customization
BXW-R	Stator	0.30 ～ 2.50	—	—	Customization	Customization	Customization	Customization
BXR-LE	Stator	0.32 ～ 1.32	—	—	Std.	Customization	Customization	Customization
BXR	Stator	5 ～ 55	—	—	Std.	Customization	Customization	Customization
BXL	Stator	2 ～ 22	Option	—	Customization	Option	Option	Std.
BXH	Stator	4 ～ 44	Option	—	Customization	Option	Customization	Customization
BXL-N	Stator	2 ～ 80	—	—	Customization	Option	Option	Std.

COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
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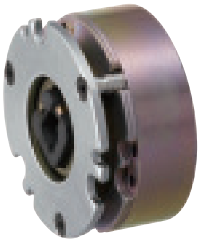
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BXW
BXR
BXL
BXH
BXL-N

Product Lineup

BXW-L/H/S

For holding and braking
2-way mounting
Quiet
Long service life
No break-in needed
RoHS



Three types for various applications

The line-up includes three types: the S type for holding, the L type for braking, and the H type for both holding and braking.

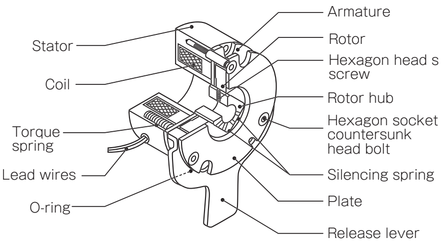
2-way mounting

The stator (a heat source) can be mounted facing either inwards or outwards.

Brake type		BXW-□-□L	BXW-□-□H	BXW-□-□S
Brake torque	[N·m]	0.12～2.00	0.24～4.00	0.36～5.20
Operating temperature	[℃]	−10～+40	−10～+40	−10～+40
Backlash		Extremely small size	Extremely small size	Extremely small size

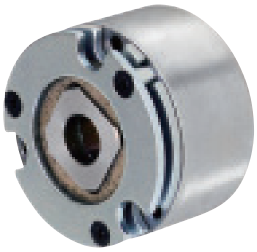
Structure

Has release lever



BXW-R

Dedicated for holding
High torque
Low inertia
No break-in needed
RoHS



Dedicated design for small servo motors

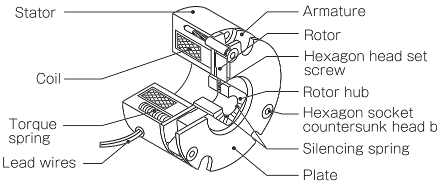
These have dedicated designs matched for specifications and dimensions for □40, □60, and □80 small servo motors.

Low-inertia rotor

We succeeded in dramatically reducing both mass and drag wear while ensuring adequate strength.

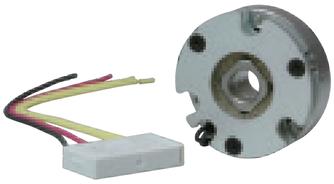
Brake torque	[N·m]	0.30～2.50
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXR-LE

Dedicated for holding
Ultra-slim
Low inertia
RoHS

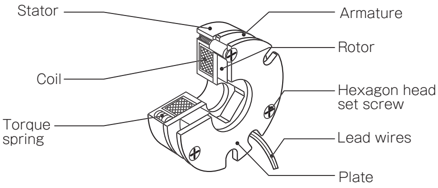


Ultra compact

Use with a built-in dedicated controller provides a range of benefits, including an ultra-thin profile, reduced energy consumption, lower heat emissions, higher torque and a longer service life.

Brake torque	[N·m]	0.32～1.32
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXR

Dedicated for holding
Ultra-slim
Low inertia
Spline
No break-in needed
RoHS

Ultra-slim

This ultra-slim design is two-thirds the thickness of our previous design.

Low-inertia rotor

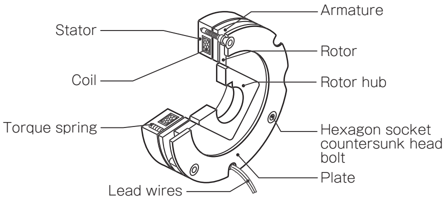
We succeeded in dramatically reducing both mass and drag wear while ensuring adequate strength.

Extremely small backlash

The backlash of the spline hub type is 0.2° to 0.5°.

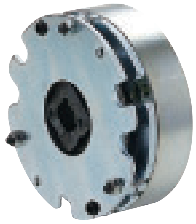
Brake torque	[N·m]	5~55
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXL

Dedicated for braking | Quiet | Stable braking | Long service life | RoHS



Low noise

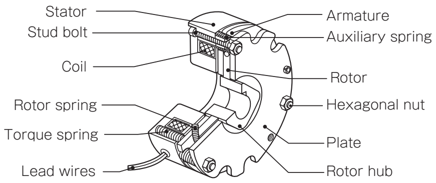
These reduce annoying high-frequency friction noise during braking. Products that reduce aperiodic noise or armature pull-in noise are also available.

Stable braking

With low torque fluctuation, these brake loads instantly even when malfunctions occur.

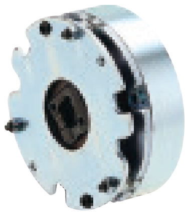
Brake torque	[N·m]	2～22
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXH

For holding and braking | High torque | Quiet | No break-in needed | RoHS



For both holding and braking

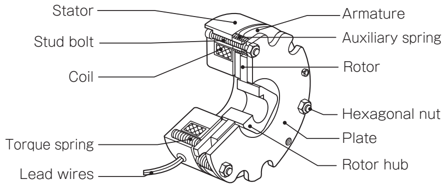
These brakes ensure sufficient torque for holding applications while also being usable as emergency brakes.

High torque

Provide twice the torque with the same dimensions as BXL models.

Brake torque	[N·m]	4~44
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXL-N

Dedicated for braking | Quiet | Stable braking | Long service life

Low noise

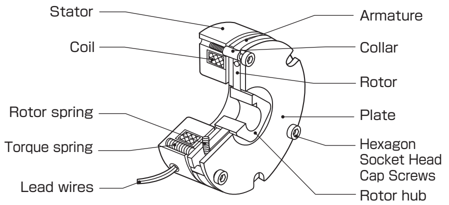
These reduce annoying high-frequency friction noise during braking. Products that reduce aperiodic noise or armature pull-in noise are also available.

Variety of torques

Two to three different kinds of braking torque for the same outer diameter are available to permit the most suitable design for the application at hand.

Brake torque	[N·m]	2～80
Operating temperature	[℃]	0～+40
Backlash		Extremely small size

Structure



Customization Examples

BXW Large Type

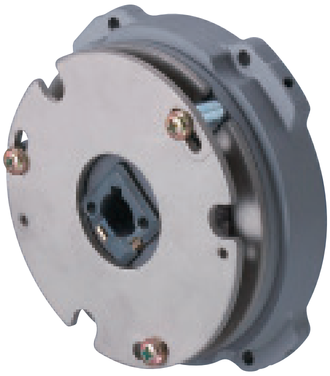
This is a large version of the BXW with static friction torque of 300 N•m. Backlash is kept extremely small by locking the rotor hub to the rotor via a disc spring.

BXW Slim Type

Ultra-slim types 15 mm thick or less are available to fit the space in your device. Power consumption can also be kept to one-third the level of our standard products by using our dedicated controllers.

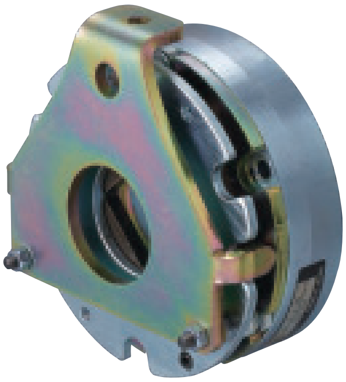
Types with Integrated Flanges

Mounting flanges and brake stators can be integrated. This helps reduce the number of components and saves space.



Special Release Levers

Release levers can also be designed for specific units to match the device construction.



Visit the MIKI PULLEY website for details.

For inquiries on customization

www.mikipulley.co.jp

Web code Z001

FAQ

Q1 I don't see anything with the torque and response I need in your standard products. Can you customize something for me?

A We can customize units in many ways: outfitting them for overexcitation power supplies or use of inrush current at motor startup, changing the frictional material, boosting torque, increasing response, extending the total energy (service life), suppressing heat generation, and more. Consult Miki Pulley for details.

Overexcitation power supply
BEW-2FH

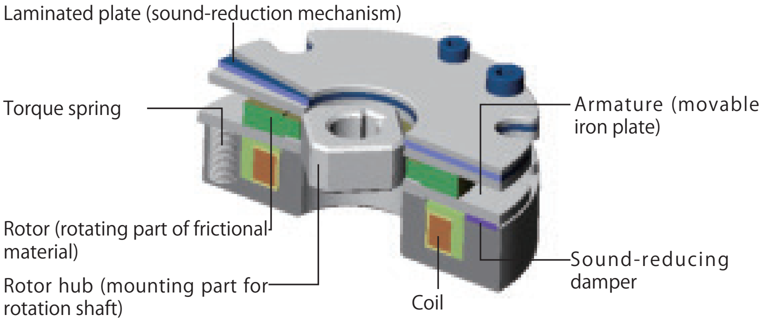
Q2 Can you handle cases in which standard products cannot be installed due to dimensional constraints?

A Yes, we can. For example, we have a long track record creating slimmer units that deliver the same torque. These units can provide the same torque while being only about half as thick as the standard product, although this will vary with your conditions. Consult Miki Pulley for details.

Q3 What do you have for dealing with noise issues?

A Spring-actuated brakes have a number of types of noises, such as (1) rattling generated by microvibrations during rotating, (2) armature pull-in and release noise, (3) friction noise (chirping) during braking, and (4) grinding noise under drive (when the brake is released). We have ways of reducing all of these. The figure below shows an example.

To reduce pull-in/release noise: Special plate specification



To reduce grinding noise: Single-side braking specification

BXW Models

Specifications

BXW-□-□L (Braking use)

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m^2]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T[J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXW-01-10L	01	0.12	12	5.0	0.417	28.8	F	5000	0.6×10^{-6}	2.5	1.5×10^{6}	0.008	0.015	0.2
			24	5.0	0.208	115	F							
			45	5.0	0.111	405	F							
			90	5.0	0.056	1622	F							
			180	5.0	0.028	6486	F							
BXW-02-10L BXW-02-12L	02	0.25	12	6.6	0.550	21.8	F	5000	1.9×10^{-6}	5.0	3.0×10^{6}	0.008	0.015	0.3
			24	6.6	0.275	87.3	F							
			45	6.6	0.147	307	F							
			90	6.6	0.073	1228	F							
			180	6.6	0.037	4912	F							
BXW-03-10L BXW-03-12L	03	0.50	12	9.0	0.750	16.0	F	5000	3.8×10^{-6}	10.0	4.5×10^{6}	0.025	0.025	0.4
			24	9.0	0.375	64.0	F							
			45	8.2	0.182	247	F							
			90	8.2	0.091	988	F							
			180	8.2	0.046	3954	F							
BXW-04-10L BXW-04-12L	04	1.00	12	11.5	0.958	12.5	F	5000	12.0×10^{-6}	20.0	7.0×10^{6}	0.030	0.030	0.6
			24	11.5	0.479	50.1	F							
			45	10.0	0.222	203	F							
			90	10.0	0.111	810	F							
			180	10.0	0.056	3241	F							
BXW-05-10L BXW-05-12L	05	2.00	12	13.0	1.083	11.1	F	5000	23.0×10^{-6}	30.0	12.0×10^{6}	0.035	0.035	0.8
			24	13.0	0.542	44.3	F							
			45	13.0	0.289	156	F							
			90	13.0	0.144	623	F							
			180	13.0	0.072	2492	F							

BXW-□-□H (Holding and braking use)

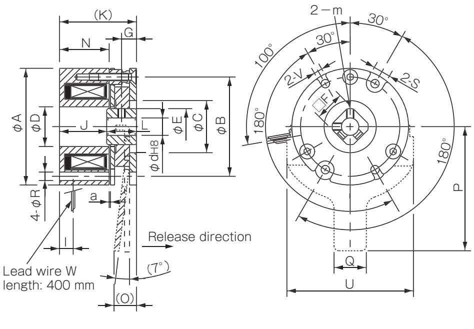
Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m^2]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T[J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXW-01-10H	01	0.24	12	5.0	0.417	28.8	F	5000	0.6×10^{-6}	0.5	0.2×10^{6}	0.010	0.010	0.2
			24	5.0	0.208	115	F							
			45	5.0	0.111	405	F							
			90	5.0	0.056	1622	F							
			180	5.0	0.028	6486	F							
BXW-02-10H BXW-02-12H	02	0.50	12	6.6	0.550	21.8	F	5000	1.9×10^{-6}	1.0	0.3×10^{6}	0.010	0.010	0.3
			24	6.6	0.275	87.3	F							
			45	6.6	0.147	307	F							
			90	6.6	0.073	1228	F							
			180	6.6	0.037	4912	F							
BXW-03-10H BXW-03-12H	03	1.00	12	9.0	0.750	16.0	F	5000	3.8×10^{-6}	2.0	0.5×10^{6}	0.035	0.020	0.4
			24	9.0	0.375	64.0	F							
			45	8.2	0.182	247	F							
			90	8.2	0.091	988	F							
			180	8.2	0.046	3954	F							
BXW-04-10H BXW-04-12H	04	2.00	12	11.5	0.958	12.5	F	5000	12.0×10^{-6}	4.0	1.0×10^{6}	0.040	0.025	0.6
			24	11.5	0.479	50.1	F							
			45	10.0	0.222	203	F							
			90	10.0	0.111	810	F							
			180	10.0	0.056	3241	F							
BXW-05-10H BXW-05-12H	05	4.00	12	13.0	1.083	11.1	F	5000	23.0×10^{-6}	6.0	2.0×10^{6}	0.045	0.030	0.8
			24	13.0	0.542	44.3	F							
			45	13.0	0.289	156	F							
			90	13.0	0.144	623	F							
			180	13.0	0.072	2492	F							

BXW-□-□S (Holding use)

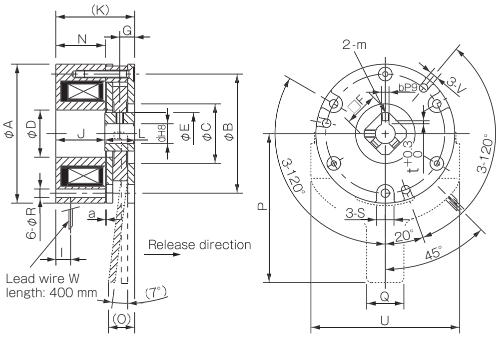
Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m^2]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T[J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXW-01-10S	01	0.36	24	5.0	0.208	115	F	5000	0.6×10^{-6}	–	–	0.025	0.010	0.2
BXW-02-10S BXW-02-12S	02	0.75	24	6.6	0.275	87.3	F	5000	1.9×10^{-6}	–	–	0.030	0.010	0.3
BXW-03-10S BXW-03-12S	03	1.50	24	9.0	0.375	64.0	F	5000	3.8×10^{-6}	–	–	0.035	0.020	0.4
BXW-04-10S BXW-04-12S	04	2.60	24	11.5	0.479	50.1	F	5000	12.0×10^{-6}	–	–	0.040	0.025	0.6
BXW-05-10S BXW-05-12S	05	5.20	24	13.0	0.542	44.3	F	5000	23.0×10^{-6}	–	–	0.045	0.030	0.8

* The armature pull-in time and armature release time are taken during DC switching.

Dimensions



Size #01, #02



Size #03, #04, #05

Unit [mm]

Size	Radial direction dimensions															Axial direction dimentions							Bore dimensions		
	A	B	C	D	E	S	V	R	F	W	m	O	P	Q	U	G	I	J	K	L	N	a	d	b	t
01	37	32	18	13.5	12.0	6	3	3	10	AWG26	M3	—	—	—	—	4.5	5.0	22.5	32	9	22.5	0.10	5 6	—	—
02	47	40	21	16.0	14.5	7	3.4	3.4	12	AWG26	M3	9	50	13	51	6.0	5.5	19.2	32	12	20.0	0.10	6 7	—	—
03	56	48	24	19.0	17.0	7	3.4	3.4	14	AWG26	M3	11	60	15	60	6.0	6.0	19.9	32	12	20.0	0.15	8	—	—
04	65	58	35	24.0	22.0	7	3.4	3.4	18	AWG22	M4	12	70	15	70	7.0	7.0	19.9	34	14	21.0	0.15	10	3	1.2
05	75	66	36	28.0	26.5	9	4.5	4.5	22	AWG22	M4	14	80	20	80	7.0	7.0	22.1	36	14	21.5	0.15	12	4	1.5

* There is no release lever option for size #01.

How to Place an Order

BXW-01-10L-24V-5

Size

Release lever
10: Not included
12: Included

Application L: Braking-use H: Holding- and braking-use
S: Holding use

Voltage (Specifications table)

Bore diameter (dimensional symbol d)

* Models equipped with the release lever and models with 12-V and 180-V voltage specifications are made to order.
* Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

Options: Dust Cover

Dust covers are available as options. These enable use in challenging environments by keeping out foreign matter.
Dust covers come in two types: full covers that have no hole for the shaft, and shaft-hole covers, which can be used on brakes mounted with the shaft passing through. You can also choose the locations of the lead exit holes for brakes mounted on plates or mounted on stators.

How to Place an Order

BXW-01-C02

Brake size
01, 02, 03, 04, 05

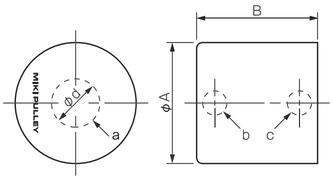
Shape no.
01, 02, 03, 04, 05, 06

Specifications

Material	Ethylene propylene diene monomer (EPDM) rubber
Temperature range	-40℃ to 140℃
Exterior color	Black
Applicable brake models	L type, H type, S type BXW models
Applicable brake sizes	#01, #02, #03, #04, #05
Applicable specification voltages	12 V DC, 24 V DC, 45 V DC, 90 V DC, 180 V DC

* This temperature range is for dust cover materials. The operating temperature for BXW models is -10°C to 40°C.
* Cannot be mounted on BXW models with release levers or R-type BXW models.

Dimensions



Shape No.	a	b	c
01	×	×	×
02	×	×	○
03	×	○	×
04	○	×	×
05	○	×	○
06	○	○	×

Unit [mm]

Model	φA	B	φd
BXW-01-C□	41	33	16
BXW-02-C□	51	33	21
BXW-03-C□	60	33.5	24
BXW-04-C□	69	35.5	30
BXW-05-C□	79	37.5	30

* Symbol a indicates a hole made for brakes with shafts passing through; symbol b indicates a hole made for lead exit when mounted on a plate; symbol c indicates a hole made for lead exit when mounted on a stator.
* Shapes #01 and #04 require that a hole be made separately for leads to exit.

BXW Models

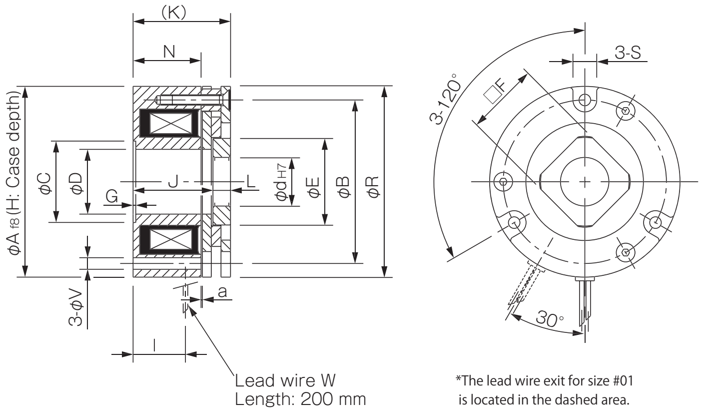
Specifications (BXW-□-□R)

(For servo motors)

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃) Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $E_{ba\ell}$ [J]	Total braking energy E_T [J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
BXW-01-10R	01	0.3	24	6.1	0.254	94.4	F	6000	1.36×10^{-7}	15	3000	0.035	0.020	0.1
BXW-03-10R	03	1.3	24	7.2	0.300	80.0	F	6000	1.17×10^{-6}	87	17000	0.050	0.020	0.3
BXW-05-10R	05	2.5	24	8.0	0.333	72.0	F	6000	3.68×10^{-6}	200	40000	0.060	0.020	0.5

* The armature pull-in time and armature release time are taken during DC switching.

Dimensions



Unit [mm]

Size	Radial direction dimensions										Axial direction dimentions								Bore dimensions	
	A	B	C	D	E	S	V	R	F	W	G	H	I	J	K	L	N	a	d	d max
01	33	26.5	16	9	14	7	3.4	32.5	12	AWG26	0.2	4	19	26	30	4	22.8	0.1	8.5	8.5
03	48	42	26	14	23	8	3.4	47.5	19	AWG22	0.2	4	18	26	30	4	22.6	0.1	11	15
05	64	56	28	22	31	8	4.5	63.5	25	AWG22	0.2	4	16	25.5	30	4.5	21.3	0.1	16	20

* Bore diameters other than the standard bore diameters given above are also possible. d max indicates the maximum bore diameter with a round shaft.
* In addition to round bores, key processing can also be handled. Consult Miki Pulley for details.
* Dimensions, mounting and the like are not interchangeable with other BXW models.

How to Place an Order

BXW-01-10R-24V-8.5

Size
Release lever
10: Not included
Bore diameter (dimensional symbol d)
Voltage (Specifications table)
Application R: Servo motor-use

*Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

Items Checked for Design Purposes

Precautions for Handling

■ Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

■ Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

■ Frictional Surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

Precautions for Use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Operating Temperature

The operating temperature range is -10° C to 40° C. If you will use the product at other temperatures, consult Miki Pulley.

■ Power Supplies

BXW models use commercial AC 100 V or 200 V single phase, full-wave rectified or half-wave rectified. Select as appropriate for your application. See the table below, "Recommended power supplies and circuit protectors," for the power supply devices we recommend.

■ Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ±10% of the rated voltage value.

■ Air Gap Adjustment

BXW models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

■ Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Recommended Power Supplies and Circuit Protectors

Recommended power supplies

Input AC power	Brake voltage	Rectification method	Recommended power supply model
AC100V 50/60Hz	DC24V	Single-phase, full-wave	BES-20-71-1
AC100V 50/60Hz	DC45V	Single-phase, half-wave	BEW-1R
AC100V 50/60Hz	DC90V	Single-phase, full-wave	BEW-1R
AC200V 50/60Hz	DC24V	Single-phase, full-wave	BES-20-71
AC200V 50/60Hz	DC90V	Single-phase, half-wave	BEW-2R
AC200V 50/60Hz	DC180V	Single-phase, full-wave	BEW-2R
AC400V 50/60Hz	DC180V	Single-phase, half-wave	BEW-4R

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

Recommended circuit protectors

Input voltage	Brake voltage	Rectification method	Recommended circuit protector (varistor)
DC24V	DC24V	–	NVD07SCD082 or an equivalent
AC100V 50/60Hz	DC45V	Single-phase, half-wave	NVD07SCD220 or an equivalent
AC100V 50/60Hz	DC90V	Single-phase, full-wave	NVD07SCD220 or an equivalent
AC200V 50/60Hz	DC90V	Single-phase, half-wave	NVD07SCD470 or an equivalent
AC200V 50/60Hz	DC180V	Single-phase, full-wave	NVD07SCD470 or an equivalent
AC400V 50/60Hz	DC180V	Single-phase, half-wave	NVD14SCD820 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* DC24V indicates a product recommended with a stepdown transformer or the like.
* BXW models do not come with circuit protectors.

Precautions for Mounting

■ Mounting Orientation

BXW models can be mounted with the stator facing inwards (stator mounted) or outwards (plate mounted). Select your mounting orientation as the application dictates. Be aware, however, that the BXW-R type is only compatible with stator centering-mark mounting. Your understanding is appreciated.

■ Affixing the Rotor Hub

Affix the rotor hub to the shaft with hex-socket-head set screws such that the rotor hub does not touch the armature or stator. If you are applying adhesive to the hex-socket-head set screws, be careful that the adhesive does not come out onto the rotor hub surface. Note also that since the BXW-R type is constructed so that the rotor hub does not go through the stator, affix it by press-fitting it onto the shaft at a position that does not touch the armature (see dimension J) when they are assembled.

■ Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

■ Shafts

The shaft tolerance should be h7 class (JIS B 0401). Be aware that the harder the material used for the shaft, the lower the effect of the hex-socket-head set screws.

■ Accuracy of Brake Attachment Surfaces

Make sure that concentricity (X) and perpendicularity (Y) do not exceed the allowable values of the table below.

Allowable concentricity and perpendicularity values for the BXW

Size	Concentricity (X)	Perpendicularity (Y)
	T.I.R. [mm]	T.I.R. [mm]
01	0.05	0.02
02	0.05	0.02
03	0.10	0.02
04	0.10	0.02
05	0.10	0.02

Stator mounted

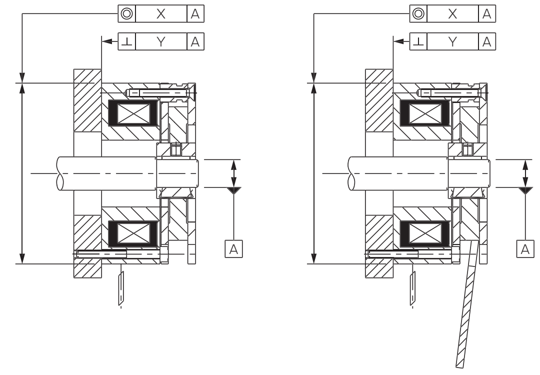
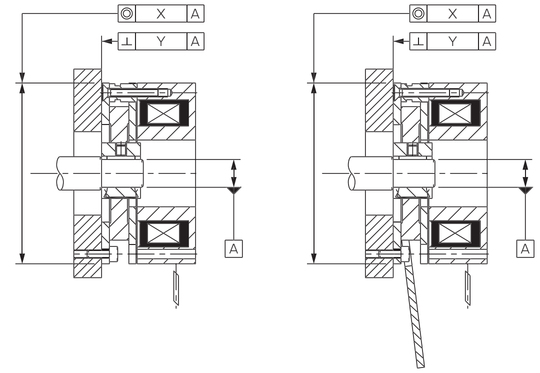


Plate mounted



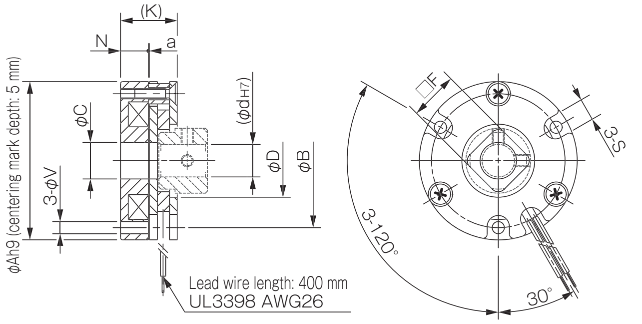
BXR-LE Models For holding

Brake unit

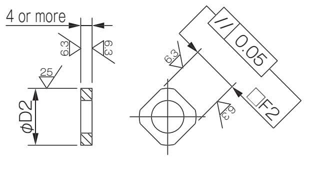
Specifications

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)					Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m^2]	Allowable braking energy rate $E_{ba\ell}$ [J]	Total braking energy E_T [J]	Armature pull-in time (24 V DC) ta [s]	Armature release time (7 V DC) tar [s]	Mass [kg]
			Output mode	Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXR-01-10LE	01	0.32	Overexcitation	24	22.0	0.92	26.2	F	6000	2.5 × 10^{-10}	15	3000	0.035	0.020	0.08
			Constant excitation	7	1.9	0.27									
BXR-02-10LE	02	0.62	Overexcitation	24	22.0	0.92	26.2	F	6000	3.8 × 10^{-10}	87	17000	0.050	0.020	0.12
			Constant excitation	7	1.9	0.27									
BXR-03-10LE	03	1.32	Overexcitation	24	26.0	1.08	22.2	F	6000	4.0 × 10^{-10}	87	17000	0.060	0.020	0.16
			Constant excitation	7	2.2	0.32									

Dimensions



Lead wire length: 400 mm
UL3398 AWG26



Rotor hub machining dimensions

*Rotor hubs are manufactured in the desired shape.

Unit [mm]

Model	Size	Radial direction dimensions								Axial direction dimentions			Rotor hub machining dimensions	
		φ A	φ B	φ C	φ D	φ d:Max.	□F	S	φ V	K	N	a	φ D2	□F2
BXR-01-10LE	01	39	33	9	18	8	12	5.5	3.0	14	7.0	0.1	$14^{\ 0}_{-0.1}$	$12^{\ 0}_{-0.07}$
BXR-02-10LE	02	48	42	15	28	14	19	5.5	3.0	14	7.0	0.1	$23^{\ 0}_{-0.1}$	$19^{\ 0}_{-0.07}$
BXR-03-10LE	03	56	50	15	27	14	19	6.5	3.4	14.5	7.4	0.1	$23^{\ 0}_{-0.1}$	$19^{\ 0}_{-0.07}$

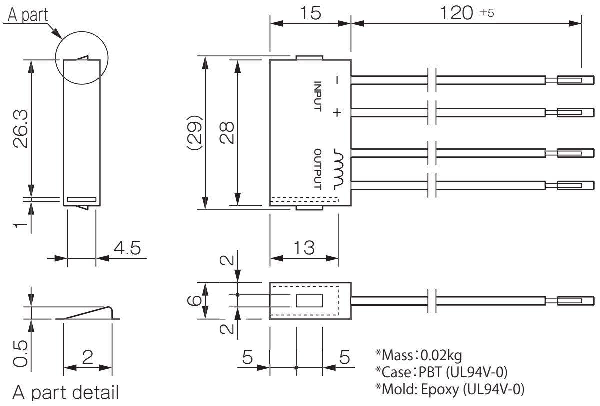
Controller

Specifications

Model	BEM-24ES7-120N
Input voltage	24V DC ± 10% smoothing power supply
Output voltage	Initial: 24 V DC (0.2 sec.) Constant: 7 V DC (± 10%), PWM control
Max. output current	1.0 A DC (ambient temp.: 20° C), 0.8 A DC (ambient temp.: 60° C)
Time rating	Continuous
Insulating resistance	500 V DC, 100 M Ω with Megger (input/output - between terminal and case)
Dielectric strength voltage	1000 V AC, 50/60 Hz, 1 min. (input/output - between terminal and case)
Ambient environment	-20 to 60° C, 5 to 95% RH, no condensation/freezing

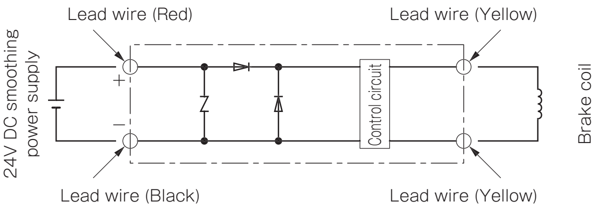
Lead wire	Function	Description	Specification
Red	Input (+)	Connects the 24 V DC smoothing power supply (+)	UL3398 AWG22
Black	Input (−)	Connects the 24 V DC smoothing power supply (-)	UL3398 AWG22
Yellow	Output	Connects the spring-actuated brake (either pole)	UL3398 AWG22
Yellow	Output	Connects the spring-actuated brake (either pole)	UL3398 AWG22

Dimensions

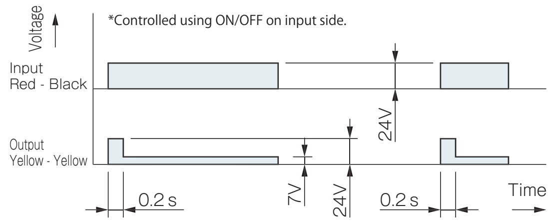


*Mass：0.02kg
*Case：PBT (UL94V-0)
*Mold: Epoxy (UL94V-0)

Structure

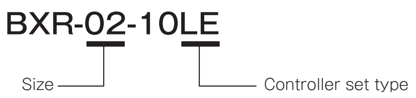


Timing Chart



*Controlled using ON/OFF on input side.

How to Place an Order



Items Checked for Design Purposes

Precautions for Handling

Brakes

Electromagnetic brakes use many soft materials. Care should be taken during handling as accidentally striking, dropping or applying excessive force to the brake could cause denting or deformation.

Lead wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles or allow them to hang too low.

Friction Surfaces

Since these are dry brakes, they must be used with the friction surfaces dry. Keep water and oil away from the friction surfaces when handling the brakes.

Precautions for Mounting

Affixing the Rotor Hub

The BXR LE models are specifically designed to be as compact as possible and the rotor hub can be freely designed for a particular purpose. In the design, the rotor hub should be installed such that it does not touch the armature or stator. Also, with the normal installation method of using hexagon-socket set screws coated with adhesive, take care not to trap adhesive between the screws and the rotor hub surface.

Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread locking compound to bolts and screws used to install brakes.

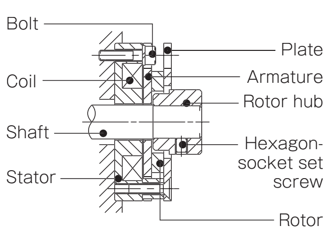
Shafts

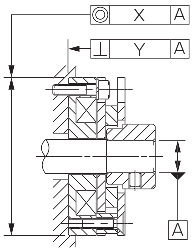
The shaft tolerance should be h7 class (JIS B 0401).

Accuracy of Brake Attachment Surfaces

Make sure that the centering mark and shaft concentricity (X) and the shaft perpendicularity (Y) relative to the brake mounting surface do not exceed the allowable values in the table below.

Model	Size	Concentricity (X)	Perpendicularity (Y)
		T.I.R. [mm]	T.I.R. [mm]
BXR-01-10LE	01	0.05	0.02
BXR-02-10LE	02	0.05	0.02
BXR-03-10LE	03	0.10	0.02





Precautions for Use

Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust or other particles that could affect the braking system.

Operating Temperature

The operating temperature range is -10° C to 40° C for brakes and -20° C to 60° C for dedicated controllers. If you will use the product at other temperatures, consult Miki Pulley.

Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme fluctuations in power supply voltage. Keep the power supply voltage to within ± 10% of the rated voltage.

Air Gap Adjustment

BXR LE models do not require air gap adjustment. The brake air gap is adjusted at shipment from the factory.

Circuit Protectors

Circuit protectors should not be connected as they are built into the dedicated controllers.

Controller Operation

The control function is operated by the ON/OFF switch on the input side, so switching should be carried out by the input side of the dedicated controller.

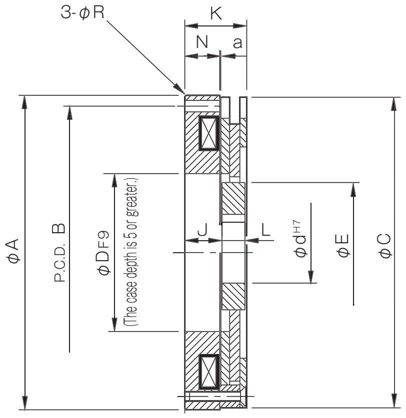
BXR Models Square Hub Type

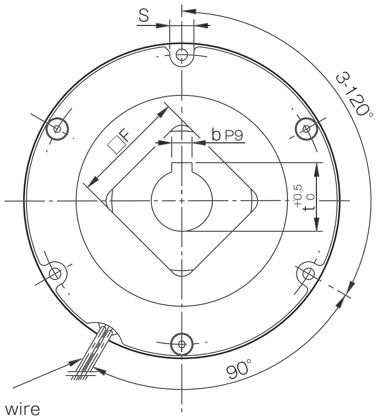
Specifications (BXR- □ -10)

Model	Size	Static friction torque Ts [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate Ebaℓ [J]	Total braking energy ET[J]	Armature pull-in time ta [s]	Armature release time tar [s]	Backlash [°]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
BXR-06-10-005	06	5	24	17.6	0.73	32.7	F	5000	2.35×10^{-5}	500	2.0×10^{5}	0.050	0.020	1.2	0.9
BXR-08-10-012	08	12	24	19.4	0.81	29.7	F	5000	3.45×10^{-5}	800	2.0×10^{5}	0.080	0.020	1.2	1.2
BXR-10-10-016	10	16	24	21.5	0.90	26.8	F	5000	1.12×10^{-4}	1500	2.2×10^{6}	0.110	0.050	0.9	1.3
BXR-12-10-030	12	30	24	23.7	0.99	24.3	F	5000	1.88×10^{-4}	1500	2.5×10^{6}	0.120	0.030	0.8	2.3
BXR-14-10-038	14	38	24	31.0	1.29	18.6	F	3600	4.22×10^{-4}	1800	3.0×10^{6}	0.120	0.030	0.5	3.0
BXR-16-10-055	16	55	24	19.0	0.79	30.3	F	3600	7.10×10^{-4}	2000	3.0×10^{6}	0.220	0.100	0.5	3.6

* The armature pull-in time and armature release time are taken during DC switching.
* Backlash is the value between the rotor and rotor hub.

Dimension (BXR- □ -10)





Lead wire
length: 400
*The lead wire extraction position for size 14° is 60°.

Unit [mm]

Size	Radial direction dimensions								Axial direction dimentions					Bore diameter			
	A	B	C	D	E	F	R	S	J	L	N	K	a	d	b	t	d max
06	83.5	76	82	47	42	35	4.5	9	17.0	7	14.7	25.0	0.10	20	6	22.5	25
08	93.5	85	92	49	42	35	4.5	10	19.0	7	15.7	27.0	0.10	20	6	22.5	25
10	123.5	115	122	62	55	45	4.5	9.5	14.6	9	13.7	24.3	0.10	24	8	27	28
12	137.5	130	136	65	62	50	4.5	12	15.4	9	12.5	25.0	0.15	24	8	27	30
14	167.5	158	166	80	74	60	5.5	12	16.0	9	12.0	25.0	0.15	28	8	31	38
16	185	175	184	100	86	65	5.5	12.5	21.3	11.5	19.4	32.8	0.20	28	8	31	45

How to Place an Order

BXR-14-10-038-24V-28DIN

Size
Shape fitting
10: Square
Static friction torque [N·m]
(Refer to the Specifications table for details on the three-digit code.)
Voltage
Bore diameter (dimensional symbol d)

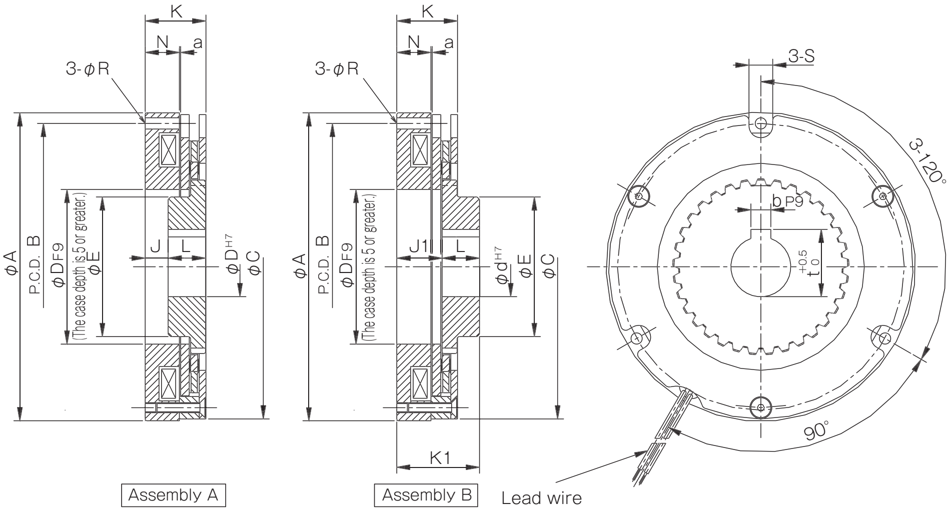
BXR Models Spline Hub Type

Specifications (BXR- ☐ -20)

Model	Size	Static friction torque Ts [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate Ebaℓ [J]	Total braking energy ET[J]	Armature pull-in time ta [s]	Armature release time tar [s]	Backlash [°]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
BXR-06-20-005	06	5	24	17.6	0.73	32.7	F	5000	3.43×10^{-5}	500	2.0×10^{5}	0.050	0.020	0.5	1.0
BXR-08-20-012	08	12	24	19.4	0.81	29.7	F	5000	6.75×10^{-5}	800	2.0×10^{5}	0.080	0.020	0.4	1.3
BXR-10-20-016	10	16	24	21.5	0.90	26.8	F	5000	2.32×10^{-4}	1500	2.2×10^{6}	0.110	0.050	0.3	1.5
BXR-12-20-030	12	30	24	23.7	0.99	24.3	F	5000	3.02×10^{-4}	1500	2.5×10^{6}	0.120	0.030	0.3	2.5
BXR-14-20-038	14	38	24	31.0	1.29	18.6	F	3600	9.41×10^{-4}	1800	3.0×10^{6}	0.120	0.030	0.2	3.4
BXR-16-20-055	16	55	24	19.0	0.79	30.3	F	3600	15.2×10^{-4}	2000	3.0×10^{6}	0.220	0.100	0.2	4.0

* The armature pull-in time and armature release time are taken during DC switching.
* Backlash is the value between the rotor and rotor hub.

Dimension (BXR- ☐ -20)



Assembly A

Assembly B

Lead wire
length: 400
*The lead wire extraction position for size 14° is 60° .

Unit [mm]

Size	Radial direction dimensions								Axial direction dimentions							Bore diameter			
	A	B	C	D	E	F	R	S	J	J1	L	N	K	K1	a	d	b	t	d max
06	83.5	76	82	47	36	35	4.5	9	10.5	18	12.5	14.7	25.0	30.5	0.10	20	6	22.5	25
08	93.5	85	92	49	42	35	4.5	10	11.5	20	13.5	15.7	27.0	33.5	0.10	20	6	22.5	30
10	123.5	115	122	62	56	45	4.5	9.5	9	18.2	15	13.7	24.3	33.2	0.10	24	8	27	40
12	137.5	130	136	65	61	50	4.5	12	8.8	17.8	15	12.5	25.0	32.8	0.15	24	8	27	45
14	167.5	158	166	80	75	60	5.5	12	7.2	17.2	16	12.0	25.0	33.2	0.15	28	8	31	55
16	185	175	184	100	82	65	5.5	12.5	13.6	24.6	18	19.4	32.7	42.6	0.20	28	8	31	65

How to Place an Order

BXR-14-20-038-24V-28DIN

Size

Voltage

Bore diameter (dimensional symbol d)

Static friction torque [N·m]
(Refer to the Specifications table for details on the three-digit code.)

Shape fitting
20: Spline

BXR Models

Items Checked for Design Purposes

Precautions for Handling

■ Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

■ Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

■ Frictional Surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

Precautions for Use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Operating Temperature

The operating temperature range is -10° C to 40° C. If you will use the product at other temperatures, consult Miki Pulley.

■ Power Supplies

BXR models use commercial AC 100 V or 200 V single phase, full-wave rectified. Select as appropriate for your application. See the table, "Recommended power supplies and circuit protectors," for the power supply devices we recommend.

■ Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ±10% of the rated voltage value.

■ Air Gap Adjustment

BXR models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

■ Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Precautions for Mounting

Affixing the Rotor Hub

Affix the rotor hub to the shaft with bolts, snap rings, or the like such that the rotor hub does not touch the armature or stator. Leave at least dimension J on spline hub types, since the rotor hub may contact the armature.

Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

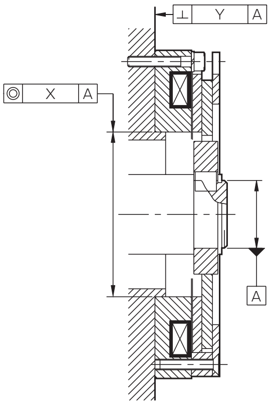
Shafts

The shaft tolerance should be h7 class (JIS B 0401).

Accuracy of Brake Attachment Surfaces

Ensure that the concentricity (X) of the centering mark and shaft and the perpendicularity (Y) of the brake mounting surface and shaft do not exceed allowable values.

Size	Concentricity (X)	Perpendicularity (Y)
	T.I.R. [mm]	T.I.R. [mm]
06	0.3	0.04
08	0.3	0.05
10	0.4	0.05
12	0.4	0.06
14	0.6	0.06
16	0.6	0.07



Recommended Power Supplies and Circuit Protectors

Recommended power supplies

Input AC power	Brake voltage	Rectification method	Brake size	Recommended power supply model
AC100V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71-1
AC100V 50/60Hz	DC24V	Single-phase, full-wave	12,14,16	BES-20-72-1
AC200V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71
AC200V 50/60Hz	DC24V	Single-phase, full-wave	12,14,16	BES-20-72

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

Circuit protector

Brake voltage	Included varistors
DC24V	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.

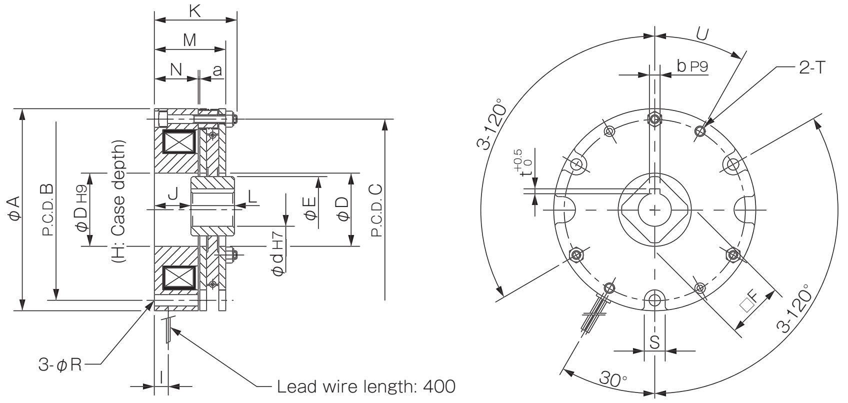
BXL Models

Specifications

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T [J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXL-06-10	06	2	DC24	15	0.63	38.4	F	5000	3.75×10^{-5}	58.3	2.0×10^7	0.035	0.020	0.9
			DC45	12	0.27	169	F							
			DC90	12	0.13	677	F							
BXL-08-10	08	4	DC24	23	0.94	25.6	F	5000	6.25×10^{-5}	91.7	3.5×10^7	0.040	0.020	1.3
			DC45	18	0.41	110	F							
			DC90	18	0.21	440	F							
BXL-10-10	10	8	DC24	27	1.14	21.1	F	4000	13.75×10^{-5}	108.3	6.2×10^7	0.050	0.025	2.3
			DC45	25	0.54	83.0	F							
			DC90	25	0.27	331	F							
BXL-12-10	12	16	DC24	35	1.46	16.2	F	3600	33.75×10^{-5}	133.3	9.0×10^7	0.070	0.030	3.4
			DC90	30	0.33	271	F							
BXL-16-10	16	22	DC24	39	1.64	14.6	F	3000	7.35×10^{-4}	183.3	11.4×10^7	0.100	0.035	5.4
			DC90	39	0.43	207	F							

* The armature pull-in time and armature release time are taken during DC switching.
* See the operating characteristics page for the armature pull-in time and release time during AC-side switching (half-wave rectified).

Dimensions



Unit [mm]

Size	A	B	C	D	E	F	H	I	J	K	L	M	N	R	S	T	U	a	d	b	t
06	83	73	73	28	26.5	22	3	10	20.5	39.5	14	33.6	20	4.5	9	2－M5	30°	0.15	11	4	1.5
08	96	86	86	35	32	25	3	12	20	41	17	35	20.8	5.5	10	2－M5	30°	0.15	14	5	2
10	116	104	104	42	38	30	3	9.5	21	47.5	25	41	25.3	6.5	12	2－M6	30°	0.2	19	6	2.5
12	138	124	124	50	45	35	4	12	19	49.8	30	43.5	23.3	6.5	12	2－M6	30°	0.2	24	8	3
16	158	142	143	59	55	45	4	14	22.5	57.5	35	51	27.7	9	15	2－M8	40°	0.25	28	8	3

How to Place an Order

BXL-06-10G 24V 11DIN

Size
Option number
10: Standard
Bore diameter (dimensional symbol d)
Voltage (Specifications table)

*Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

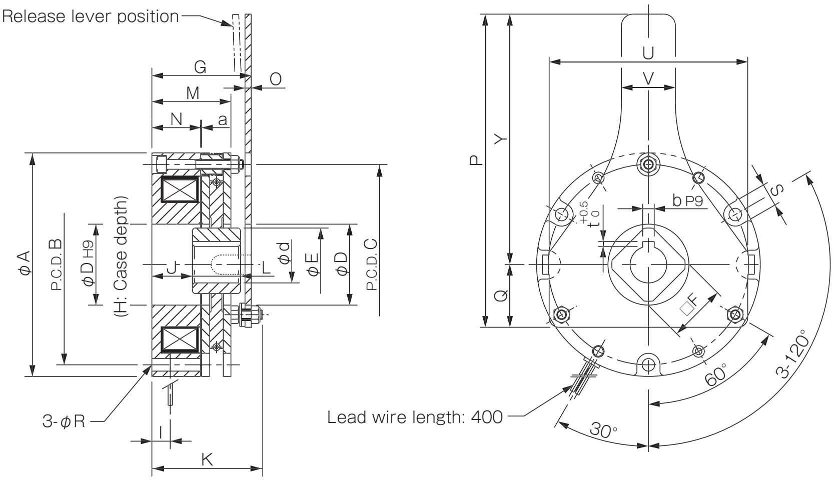
Option

Made to Order

Release Lever

Option No.: 12

In addition to the manual release tap of the standard product, we also offer an optional manual release lever. See the dimensions table below for the dimensions of brakes with release levers. Other specifications are the same as the standard specifications.



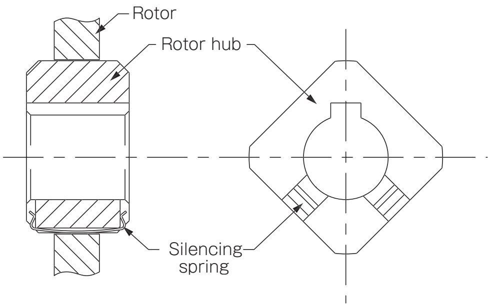
Unit [mm]

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Y	U	V	S	a	d	b	t
BXL-06-12	83	73	73	28	26.5	22	42.8	3	10	20.5	49.5	14	33.7	20	2.6	88	24	4.5	64	73	16	9	0.15	11	4	1.5
BXL-08-12	96	86	86	35	32	25	44.4	3	12	20	51	17	35	20.8	2.9	122	27	5.5	95	85	20	10	0.15	14	5	2
BXL-10-12	116	104	104	42	38	30	51.5	3	9.5	21	57.5	25	41	25.3	3.2	162.5	32.5	6.5	130	103	28	12	0.2	19	6	2.5
BXL-12-12	138	124	124	50	45	35	55.7	4	12	19	64.8	30	43.5	23.3	5	200	40	6.5	160	121	36	12	0.2	24	8	3
BXL-16-12	158	142	143	59	55	45	64.2	4	14	22.5	72.5	35	51	27.7	6	230	44	9	186	140	36	15	0.25	28	8	3

Quiet Mechanism (Silencing Spring)

Option No.: S1

There is a extremely small structural backlash (see figure on the right) between the rotor and the rotor hub. In applications that are prone to microvibrations of the drive shaft such as single-phase motors, this backlash may produce rattling (banging). The silencing spring for the rotor hub reduces this rattling.



Quiet Mechanism (Pull-in Noise Reduction Mechanism)

Option No.: S2

When the brake is energized, a magnetic circuit is formed, and the armature is pulled to the stator by that magnetic force. At that time, the armature touches the magnetic pole of the stator and a noise is produced. This sound (pull-in noise) is reduced by putting shock absorbing material in the stator's magnetic pole part.

In option S2, in addition to the pull-in noise reduction mechanism, the silencing spring (option S1) is also supplemented.

List of Option Numbers

Description of options	No quiet mechanism	Silencing spring	Silencing spring + Pull-in noise reduction mechanism
No release lever	10	10S1	10S2
Has release lever	12	12S1	12S2

* Option 10 uses standard specifications.

BXL-06-12S1G 24V 11DIN

Option no.

BXL Models

Items Checked for Design Purposes

Precautions for Handling

Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

Precautions for Mounting

Affixing the Rotor Hub

Affix the rotor hub to the shaft with bolts, snap rings, or the like such that the rotor hub does not touch the armature or stator.

Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

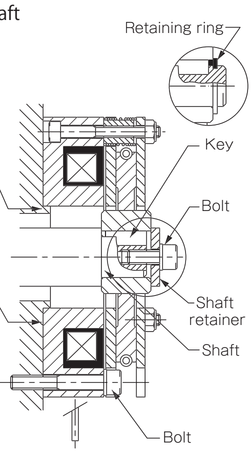
Shafts

The shaft tolerance should be h6 or js6 class (JIS B 0401).

Accuracy of Brake Attachment Surfaces

Ensure that the concentricity of the centering mark and shaft and the perpendicularity of the brake mounting surface and shaft do not exceed the following allowable values.

- Concentricity of centering mark and shaft
  - BXL-06: 0.4 T.I.R. or below
  - BXL-08: 0.4 T.I.R. or below
  - BXL-10: 0.4 T.I.R. or below
  - BXL-12: 0.6 T.I.R. or below
  - BXL-16: 0.6 T.I.R. or below
- Perpendicularity of stator mounting surface
  - BXL-06: 0.04 T.I.R. or below
  - BXL-08: 0.05 T.I.R. or below
  - BXL-10: 0.05 T.I.R. or below
  - BXL-12: 0.06 T.I.R. or below
  - BXL-16: 0.07 T.I.R. or below



Precautions for Use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

■ Operating Temperature

The operating temperature is -10° C to 40° C (no freezing or condensation). If you will use the product at other temperatures, consult Miki Pulley.

■ Manual Release

BXL models can be released manually.

Alternately tighten screws in two or three of the tap holes on the plate to press the armature.

The screw tips will push against the armature and release it with about a 90° rotation. Do not force the screws in more than that.

■ Air Gap Adjustment

BXL models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory. When first used, no gap adjustment is needed, so do not rotate the nut.

■ Initial Torque

The torque may be lower than the indicated value at initial use. In such cases, run it to break in the frictional surface before use.

■ Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Recommended Power Supplies and Circuit Protectors

Recommended power supplies

Input AC power	Brake voltage	Rectification method	Brake size	Recommended power supply model
AC100V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71-1
AC100V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72-1
AC100V 50/60Hz	DC45V	Single-phase, half-wave	06,08,10	BEW-1R
AC100V 50/60Hz	DC90V	Single-phase, full-wave	06,08,10,12,16	BEW-1R
AC200V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71
AC200V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

Recommended circuit protectors

Input voltage	Brake voltage	Rectification method	Recommended circuit protector (varistor)
DC24V	DC24V	—	NVD07SCD082 or an equivalent
AC100V 50/60Hz	DC45V	Single-phase, half-wave	NVD07SCD220 or an equivalent
AC100V 50/60Hz	DC90V	Single-phase, full-wave	NVD07SCD220 or an equivalent
AC200V 50/60Hz	DC90V	Single-phase, half-wave	NVD07SCD470 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.

* DC24V indicates a product recommended with a stepdown transformer or the like.

Included varistors

Brake voltage	Included varistors
DC24V	NVD07SCD082 or an equivalent
DC45V	No varistor provided
DC90V	No varistor provided

BXH Models

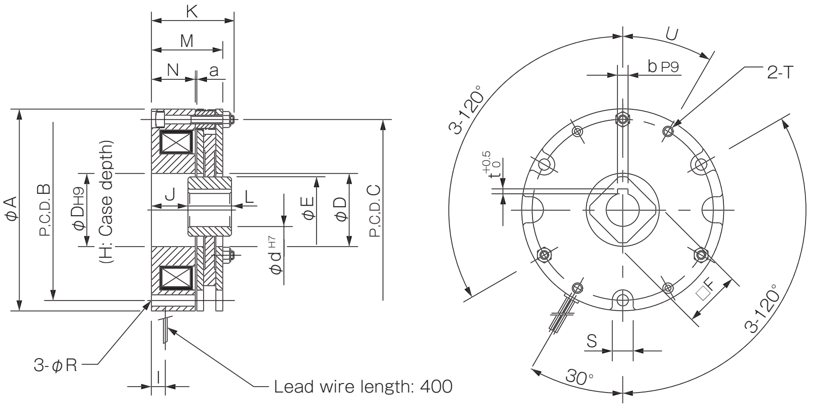
Specifications

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $E_{ba\ell}$ [J]	Total braking energy E_T [J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXH-06-10	06	4	DC24	15	0.63	38.4	F	5000	3.25×10^{-5}	700	2.0×10^6	0.040	0.020	0.9
			DC45	12	0.27	169	F							
			DC90	12	0.13	677	F							
BXH-08-10	08	8	DC24	23	0.94	25.6	F	5000	5.75×10^{-5}	1100	3.5×10^6	0.045	0.020	1.3
			DC45	18	0.41	110	F							
			DC90	18	0.21	440	F							
BXH-10-10	10	16	DC24	27	1.14	21.1	F	4000	1.30×10^{-4}	1300	6.2×10^6	0.070	0.025	2.3
			DC45	25	0.54	83	F							
			DC90	25	0.27	331	F							
BXH-12-10	12	32	DC24	35	1.46	16.2	F	3600	3.20×10^{-4}	1600	9.0×10^6	0.090	0.025	3.4
			DC90	30	0.33	271	F							
BXH-16-10	16	44	DC24	39	1.64	14.6	F	3000	6.93×10^{-4}	2200	11.4×10^6	0.125	0.030	5.4
			DC90	39	0.43	207	F							

* The armature pull-in time and armature release time are taken during DC switching.

* See the operating characteristics page for the armature pull-in time and release time during AC-side switching (half-wave rectified).

Dimensions



Unit [mm]

Size	A	B	C	D	E	F	H	I	J	K	L	M	N	R	S	T	U	a	d	b	t
06	83	73	73	28	26.5	22	3	10	20.5	39.5	14	33.6	20	4.5	9	2 − M5	30°	0.15	11	4	1.5
08	96	86	86	35	32	25	3	12	20	41	17	35	20.8	5.5	10	2 − M5	30°	0.15	14	5	2
10	116	104	104	42	38	30	3	9.5	21	47.5	25	41	25.3	6.5	12	2 − M6	30°	0.2	19	6	2.5
12	138	124	124	50	45	35	4	2	19	49.8	30	43.5	23.3	6.5	12	2 − M6	30°	0.2	24	8	3
16	158	142	143	59	55	45	4	14	22.5	57.5	35	51	27.7	9	15	2 − M8	40°	0.25	28	8	3

How to Place an Order

BXH-06-10G 24V 11DIN

Size

Option number
10: Standard

Bore diameter (dimensional symbol d)

Voltage (Specifications table)

*Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

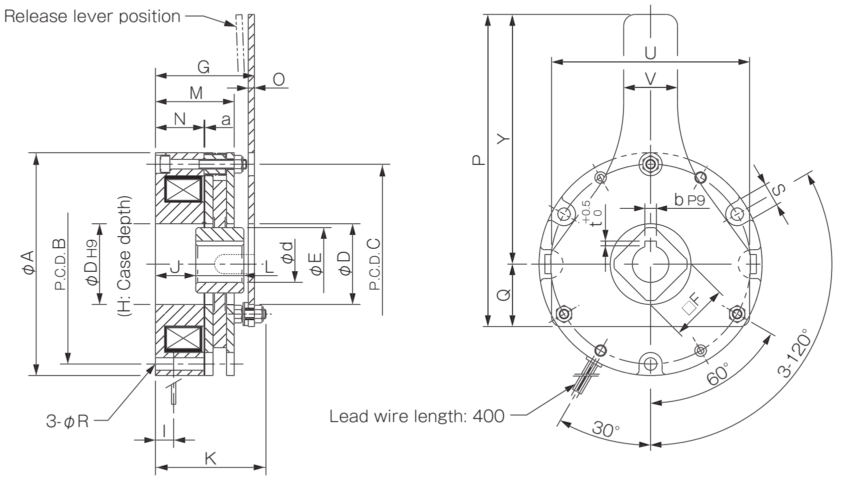
Option

Made to Order

Release Lever

Option No.: 12

In addition to the manual release tap of the standard product, we also offer an optional manual release lever. See the dimensions table below for the dimensions of brakes with release levers. Other specifications are the same as the standard specifications.



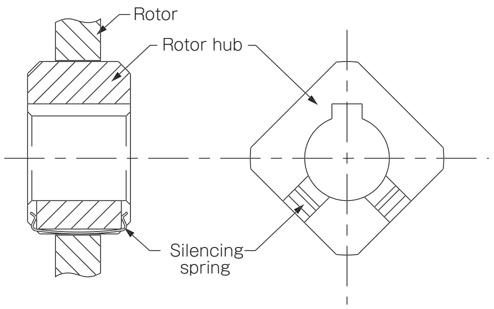
Unit [mm]

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Y	U	V	S	a	d	b	t
BXH-06-12	83	73	73	28	26.5	22	42.8	3	10	20.5	49.5	14	33.7	20	2.6	88	24	4.5	64	73	16	9	0.15	11	4	1.5
BXH-08-12	96	86	86	35	32	25	45.4	3	12	20	56	17	35.3	20.8	4	122	27	5.5	95	85	20	10	0.2	14	5	2
BXH-10-12	116	104	104	42	38	30	53.9	3	9.5	21	62.5	25	42.2	25.3	4.5	162.5	32.5	6.5	130	103	28	12	0.25	19	6	2.5
BXH-12-12	138	124	124	50	45	35	58.3	4	12	19	69.8	30	45.4	23.3	5	200	40	6.5	160	121	36	12	0.25	24	8	3
BXH-16-12	158	142	143	59	55	45	66.5	4	14	22.5	75.5	35	53.3	27.7	6	230	44	9	186	140	36	15	0.25	28	8	3

Quiet Mechanism (Silencing Spring)

Option No.: S1

There is a extremely small structural backlash (see figure on the right) between the rotor and the rotor hub. In applications that are prone to microvibrations of the drive shaft such as single-phase motors, this backlash may produce rattling (banging). The silencing spring for the rotor hub reduces this rattling.



List of Option Numbers

Description of options	No quiet mechanism	With silencing spring
No release lever	10	10S1
Has release lever	12	12S1

* Option 10 uses standard specifications.

BXH-06-12S1G 24V 11DIN

Option no.

BXH Models

Items Checked for Design Purposes

Precautions for Handling

■ Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

■ Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

Precautions for Mounting

■ Affixing the Rotor Hub

Affix the rotor hub to the shaft with bolts, snap rings, or the like such that the rotor hub does not touch the armature or stator.

■ Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

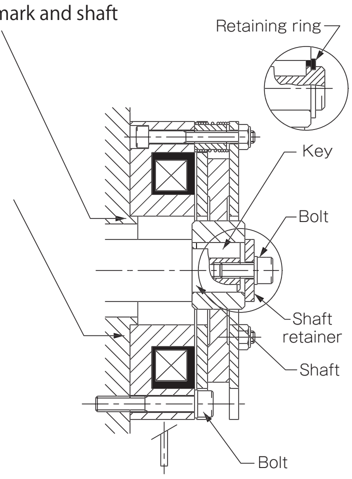
■ Shafts

The shaft tolerance should be h6 or js6 class (JIS B 0401).

■ Accuracy of Brake Attachment Surfaces

Ensure that the concentricity of the centering mark and shaft and the perpendicularity of the brake mounting surface and shaft do not exceed the following allowable values.

- Concentricity of centering mark and shaft
  BXH-06: 0.4 T.I.R. or below
  BXH-08: 0.4 T.I.R. or below
  BXH-10: 0.4 T.I.R. or below
  BXH-12: 0.6 T.I.R. or below
  BXH-16: 0.6 T.I.R. or below
- Perpendicularity of stator mounting surface
  BXH-06: 0.04 T.I.R. or below
  BXH-08: 0.05 T.I.R. or below
  BXH-10: 0.05 T.I.R. or below
  BXH-12: 0.06 T.I.R. or below
  BXH-16: 0.07 T.I.R. or below



Precautions for Use

Dedicated for Holding

These brakes are dedicated holding brakes. Do not use them for ordinary braking, except for emergency braking in the event of a power outage or the like.

Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ±10% of the rated voltage value.

Operating Temperature

The operating temperature is -10°C to 40°C (no freezing or condensation). If you will use the product at other temperatures, consult Miki Pulley.

Manual Release

BXH models can be released manually.

Alternately tighten screws in two or three of the tap holes on the plate to press the armature.

The screw tips will push against the armature and release it with about a 90° rotation. Do not force the screws in more than that.

Air Gap Adjustment

BXH models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory. When first used, no gap adjustment is needed, so do not rotate the nut.

Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Recommended Power Supplies and Circuit Protectors

Recommended power supplies

Input AC power	Brake voltage	Rectification method	Brake size	Recommended power supply model
AC100V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71-1
AC100V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72-1
AC100V 50/60Hz	DC45V	Single-phase, half-wave	06,08,10	BEW-1R
AC100V 50/60Hz	DC90V	Single-phase, full-wave	06,08,10,12,16	BEW-1R
AC200V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71
AC200V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

Recommended circuit protectors

Input voltage	Brake voltage	Rectification method	Recommended circuit protector (varistor)
DC24V	DC24V	—	NVD07SCD082 or an equivalent
AC100V 50/60Hz	DC45V	Single-phase, half-wave	NVD07SCD220 or an equivalent
AC100V 50/60Hz	DC90V	Single-phase, full-wave	NVD07SCD220 or an equivalent
AC200V 50/60Hz	DC90V	Single-phase, half-wave	NVD07SCD470 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* DC24V indicates a product recommended with a stepdown transformer or the like.

Included varistors

Brake voltage	Included varistors
DC24V	NVD07SCD082 or an equivalent
DC45V	No varistor provided
DC90V	No varistor provided

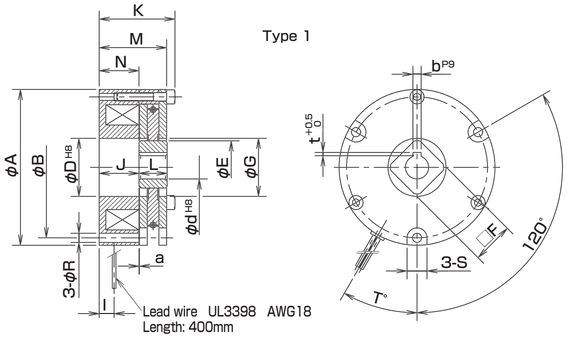
BXL-N Models

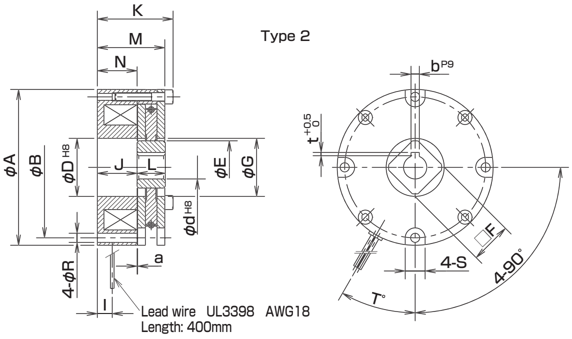
Specifications

Model	Size	Static friction torque T_s[N・m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg・m²]	Allowable braking energy rate Pbal [W]	Total braking energy E_T [J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Applicable motor output (Reference) Four poles [kW]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
BXL-08-10N-002	08	2	24	19.0	0.793	30.3	F	3600	6.3×10^{-5}	60.0	5.0×10^{7}	0.030	0.050	0.1/0.2	1.4
			99	19.0	0.192	515.8	F								
			171	19.0	0.111	1539	F								
BXL-08-10N-004	08	4	24	19.0	0.793	30.3	F	3600	6.3×10^{-5}	60.0	5.0×10^{7}	0.040	0.040	0.4	1.4
			99	19.0	0.192	515.8	F								
			171	19.0	0.111	1539	F								
BXL-10-10N-008	10	8	24	28.0	1.166	20.6	F	3600	13.8×10^{-5}	70.0	8.0×10^{7}	0.050	0.050	0.75	2.7
			99	28.0	0.283	350.0	F								
			171	28.0	0.164	1044	F								
BXL-10-10N-015	10	15	24	28.0	1.166	20.6	F	3600	13.8×10^{-5}	70.0	8.0×10^{7}	0.070	0.030	1.5	2.7
			99	28.0	0.283	350.0	F								
			171	28.0	0.164	1044	F								
BXL-12-10N-022	12	22	24	35.0	1.460	16.4	F	3600	33.8×10^{-5}	90.0	12.0×10^{7}	0.080	0.060	2.2	4.7
			99	35.0	0.353	280.1	F								
			171	35.0	0.205	835.5	F								
BXL-12-10N-030	12	30	24	35.0	1.460	16.4	F	3600	33.8×10^{-5}	90.0	12.0×10^{7}	0.100	0.030	3.0	4.7
			99	35.0	0.353	280.1	F								
			171	35.0	0.205	835.5	F								
BXL-16-10N-040	16	40	24	42.0	1.753	13.7	F	1800	73.5×10^{-5}	120.0	16.0×10^{7}	0.100	0.070	3.7	6.3
			99	42.0	0.424	233.3	F								
			171	42.0	0.246	696.1	F								
BXL-16-10N-060	16	60	24	55.0	2.294	10.5	F	1800	74.6×10^{-5}	150.0	16.0×10^{7}	0.100	0.050	5.5	6.7
			99	55.0	0.556	178.1	F								
			171	55.0	0.322	531.6	F								
BXL-16-10N-080	16	80	24	55.0	2.294	10.5	F	1800	74.6×10^{-5}	150.0	16.0×10^{7}	0.100	0.030	7.5	6.7
			99	55.0	0.556	178.1	F								
			171	55.0	0.322	531.6	F								

*The armature pull-in time and armature release time are taken during DC switching.

Dimensions





Unit [mm]

Model	Type	A	B	D	E	F	G	I	J	K	L	M	N	R	S	T	a	d	b	t
BXL-08-10N-002	1	94	85	35	32	25	35	9	24	45.7	17	40.7	24	5.5	12	30	0.3	11	4	1.5
BXL-08-10N-004	1	94	85	35	32	25	35	9	24	45.7	17	40.7	24	5.5	12	30	0.3	14	5	2
BXL-10-10N-008	1	124	110	40	38	30	42	10	22	48.7	25	42.7	26	6.5	12	30	0.3	18	6	2.5
BXL-10-10N-015	1	124	110	40	38	30	42	10	22	48.7	25	42.7	26	6.5	12	30	0.3	20	6	2.5
BXL-12-10N-022	1	150	130	49	45	35	50	18	25	57.1	30	51.1	29	6.5	14	30	0.3	24	8	3
BXL-12-10N-030	1	150	130	49	45	35	50	18	25	57.1	30	51.1	29	6.5	14	30	0.3	24	8	3
BXL-16-10N-040	1	165	150	62	55	45	62	18	24	63.1	35	55.1	28	9	15	30	0.3	28	8	3
BXL-16-10N-060	2	165	150	64	61	50	64	20	29	68.1	35	60.1	33	9	15	15	0.3	37	10	3.5
BXL-16-10N-080	2	165	150	64	61	50	64	20	29	68.1	35	60.1	33	9	15	15	0.3	37	10	3.5

How to Place an Order

BXL-08-10N-004-24V-11

Size

Static torque (refer to the specifications table)

Voltage (refer to the specifications table)

Bore diameter (dimensional symbol d)

* Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

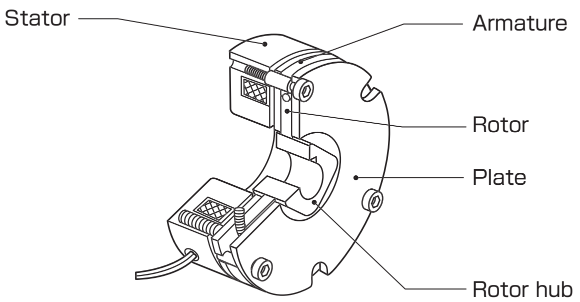
Option

Plate Installation

Standard installation is performed using stator installation, but a plate installation specification is also available as an option. Please contact Miki Pulley for assistance if desiring to use plate installation.

Quiet Mechanism

There is a slight backlash between the rotor and the rotor hub. The armature may also strike the surface of the magnetic poles on the stator when electricity flows, generating a noise. There is a quiet mechanism available that works to suppress such clattering noises as well as operating noise. Please contact Miki Pulley for details.



Items Checked for Design Purposes

Precautions for Handling

Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

Frictional Surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

Precautions for Use

Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

Operating Temperature

The operating temperature is from 0℃ to 40℃ (no freezing or condensation). If you will use the product at other temperatures, consult Miki Pulley.

Power Supplies

BXL-N models use commercial AC 220 V or 380 V single phase, half-wave rectified. Select as appropriate for your application.

Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

Air Gap Adjustment

BXL-N models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

Circuit Protectors

If using a power supply for separate DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Precautions for Mounting

Precautions for Mounting

Use a bolt or snap ring to lock the rotor hub onto the shaft.

Shaft

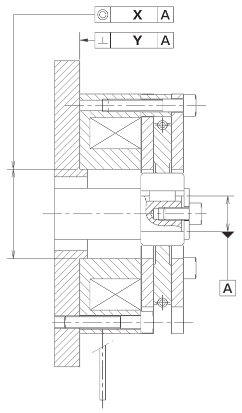
The shaft tolerance should be h7 class (JIS B 0401).

Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

Accuracy of Brake Attachment Surfaces

Ensure that the concentricity (X) of the centering mark and shaft and the perpendicularity (Y) of the brake mounting surface and shaft do not exceed allowable values.



Allowable concentricity and perpendicularity values for the BXL-N Models

Size	Concentricity (X)	Perpendicularity (Y)
	T.I.R. [mm]	T.I.R. [mm]
08	0.4	0.05
10	0.4	0.05
12	0.6	0.05
16	0.6	0.05

Recommended Power Supplies and Circuit Protectors

Model	Rectification method	Frequency [Hz]	Input AC voltage [V]	DC output voltage *1 [V]	Recommended circuit protectors *2 (Varistor)
BEM-2T	Single-phase, half-wave	50/60	AC220	DC99	NVD07SCD220 or an equivalent
BEM-4T	Single-phase, half-wave	50/60	AC380	DC171	NVD14SCD820 or an equivalent

*1 The values given are for when there is electricity flowing to the brake coil.
*2 NVD□SCD□ parts are manufactured by KOA Corporation.

Selection Procedure for Brakes for Braking

1 Consideration of Required Torque to Brake Loads

To select the appropriate brake size, you must find the torque required for braking T, and then select a size of brake that delivers a greater torque than T.

- **Consideration of cases when load conditions are not clearly known**

  When load conditions are unclear, assuming that the motor has been selected correctly for the load, the approximate torque can be obtained from the motor output using the following equation.

$$T_M = \frac{9550 \times P}{n_r} \times \eta \ [\mathrm{N \cdot m}]$$

P: Motor output [kW]
n_r: Brake shaft rotation speed $[\mathrm{min}^{-1}]$
η : Transmission efficiency from motor to brake

- **Consideration when load conditions can be clearly ascertained**

  When load conditions can be clearly ascertained, the torque T required for braking can be found using the following equation.

$$T = \left(\frac{J \times n}{9.55 \times t_{ab}} \pm T_\ell \right) \times K \ [\mathrm{N \cdot m}]$$

J: Total moment of inertia of load side $[\mathrm{kg \cdot m^2}]$
n: Rotation speed $[\mathrm{min}^{-1}]$
t_{ab}: Actual braking time [s]
T_ℓ: Load torque [N•m]
K: Safety factor (see table below)

The sign of load torque T_ℓ is minus when the load works in the direction that assists braking and plus when it works in the direction that hinders braking. The actual braking time t_{ab} is the time required from the start of braking torque generation until braking is complete. When this is not clearly known at the selection stage, a guideline value is used that factors in service life and the like.

Load state	Factor
Low-inertia/low-frequency constant load	1.5
Ordinary use with normal inertia	2
High-inertia/high-frequency load fluctuation	3

2 Provisional Size Selection

Select a brake of a size for which the torque T found in the equation of step 1 satisfies the following equation.

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_b > T \text{ (or } T_M\text{)} \ [\mathrm{N \cdot m}]$$

T_b: Brake torque [N•m]

* For brake torque, treat T_s as equaling T_b. (T_s: Static friction torque from specifications table)

3 Consideration of Energy

When the load required for braking is sufficiently small, the size can be selected considering only torque T as described above. Given the effects of heat generated by braking, however, the following equation must be used to confirm that the operation frequency per unit time and the total number of operations (service life) meet the required specifications.

Use the following equation to find the energy E_b required for a single braking operation.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_\ell} \ [\mathrm{J}]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

- **Confirm the frequency S of operations that can be performed per minute**

  Find the frequency of operations that can be performed per minute using the equation at right to confirm that the desired operation frequency is sufficiently smaller than the value found.

$$S = \frac{60 \times P_{ba\ell}}{E_b} \ [\text{times/min}]$$

$P_{ba\ell}$: Allowable braking energy rate [W]
E_b : Energy required for one braking operation [J]

- **Confirm the total number of operations (service life)**

  Find the total number of operations (service life) using the equation at right, and then check that it meets the desired service life.

$$L = \frac{E_T}{E_b} \ [\text{times}]$$

E_T: Total braking energy [J]

4 Consideration of Braking Time

When there are limits on the time required to decelerate or stop the load, use the equation at right to confirm that the total braking time t_{tb} satisfies requirements.

$$t_{tb} = t_{id} + t_{ar} + t_{ab}$$

t_{ar}: Armature release time [s]
t_{id}: Initial delay time [s]

Here, actual braking time t_{ab} is the time from the start of braking torque generation to the completion of braking. Find it with the following equation.

$$t_{ab} = \frac{J \times n}{9.55 \times (T_b \pm T_\ell)} \ [\mathrm{s}]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

5 Consideration of Stopping Precision

To confirm stopping precision, find the stopping angle (rotation) using the following equation.

$$\theta = 6 \times n \times \left(t_{id} + t_{ar} + \frac{1}{2} t_{ab} \right) \ [^\circ]$$

t_{ar}: Armature release time [s]
t_{id}: Initial delay time [s]

The variation in stopping precision--i.e., stopping precision $\Delta\theta$ --can be found empirically with the following equation and used as a guide.

$$\Delta\theta = \pm 0.15 \times \theta \ [^\circ]$$

Selection Procedure for Brakes for Holding

1

Consideration of Required Torque to Hold Loads

Use the following equation to find the torque T required to hold a load while stationary.

$$T = T_{\ell\ max} \times K\ [\mathrm{N{\bullet}m}]$$

$T_{\ell\ max}$: Max. load torque [N•m]
K: Safety factor (see table at right)

Load state	Factor
Low inertia/small load fluctuations	1.5
Ordinary use with normal inertia	2
High inertia/large load fluctuations	3

2

Provisional Selection of Size

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_s > T\ [\mathrm{N{\bullet}m}]$$

T_s: Static friction torque of brake [N•m]

3

Consideration of Energy

When considering a brake with the objective of holding loads, braking is limited to emergency braking.
Use the following equation to find the braking energy E_b for a single operation required for emergency braking. You must confirm that this result is sufficiently smaller than the allowable braking energy $E_{ba\ell}$ of the selected brake.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_\ell}\ [\mathrm{J}]$$

J: Total moment of inertia on load side [kg·m^2]
n: Rotation speed [min^{-1}]
T_b: Brake torque [N·m]
$T_{\ell\ max}$: Max. load torque [N•m]

The sign of maximum load torque $T_{\ell\ max}$ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

$$E_b \ll E_{ba\ell}\ [\mathrm{J}]$$

When using brakes for both holding and braking and the specification is indicated by allowable braking energy rate $P_{ba\ell}$, check under the following conditions.

$$E_b \ll 60 \times P_{ba\ell}\ [\mathrm{J}]$$

4

Consideration of Number of Operations

The total number of braking operations (service life) when performing emergency braking L must be found using the following equation to confirm that required specifications are satisfied.

$$L = \frac{E_T}{E_b}\ [\mathrm{times}]$$

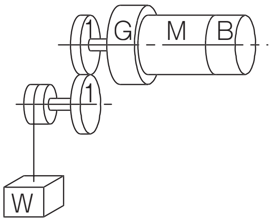
E_T: Total braking energy [J]

Note that the frequency of emergency braking will also vary with operating environment; however, it should be about once per minute or better. When the braking energy of a single operation E_b is 70% or more of the allowable braking energy $E_{ba\ell}$, however, allow the brake to cool sufficiently after emergency braking before resuming use.

BXW/BXR/BXL/BXH Models

Selection Example 1

Braking Brakes Used in Raising Loads



Selection of a brake to brake the load is as follows, as the above figure illustrates.

Motor (brake shaft) rotation speed	n	1800 [min^{-1}]
Load shaft rotation speed	n$_1$	60 [min^{-1}]
Moment of inertia of motor-side gear	J$_1$	1.5 × 10^{-2} [kg•m^2]
Moment of inertia of load-side gear	J$_2$	1.5 × 10^{-2} [kg•m^2]
Moment of inertia of load-side drum	J$_3$	4.30 [kg·m^2]
Moment of inertia of motor with speed reducer	J$_M$	6 × 10^{-3} [kg•m^2]
Moment of inertia of load	J$_A$	15.67 [kg·m^2]
Load-side torque	T	62.5 [N•m]
Number of braking operations of brake	L	53,000 cycles or more
Brake operating frequency	S	0.1 [cycles/min]

* The number of braking operations and operation frequency treat one ascending operation and one descending operation together as one cycle.

* The number of braking operations of the brake is treated as 6 (operations/h) × 8 (h/day) × 365 (days/year) × 3 (years).

Consideration of Torque

The torque required for braking is calculated from the above specifications, compared to the dynamic friction torque in the catalog, and the appropriate brake size is selected.

- Calculating the inertial moment converted to brake shaft inertial moment J$_B$
  We use the following equation to calculate the moment of inertia converted to the brake shaft (motor shaft) moment of inertia J$_B$[kg•m^2]. Here, R represents the ratio of the motor rotation speed to the load shaft rotation speed.

$$J_B=J_M+(J_1+J_2+J_3+J_A)\ \times R^2\ [\mathrm{kg\cdot m^2}]$$

$$J_B=6\times10^{-3}+(1.5\times10^{-2}+1.5\times10^{-2}+4.30+15.67)\times(60/1800)^2 \fallingdotseq 2.8\times10^{-2}[\mathrm{kg\cdot m^2}]$$

- Calculating the load torque converted to brake shaft load torque T$_\ell$
  We use the following equation to calculate the load torque converted to the brake shaft (motor shaft) load torque T$_\ell$ [N•m]. However, η indicates the transmission efficiency, which is 0.85 in this selection.

$$T_\ell=R\times T/\eta\ [\mathrm{N\cdot m}]$$

$$T_\ell=60/1800\times62.5/0.85\fallingdotseq2.45\ [\mathrm{N\cdot m}]$$

- Calculating the torque required for braking T
  Use the following equation to calculate the torque required for braking T [N•m].
  Here, the conditions are set as follows.

* The guideline for actual braking time t$_{ab}$ is 2.0 [s].

* The sign of load torque T$_\ell$ is minus when ascending because the load works in the direction that assists braking and plus when descending because the load works in the direction that hinders braking.

* Select a safety factor K of 3.0, based on operating conditions.

Ascending

$$T_{up}=\left(\frac{J_B\times n}{9.55\times t_{ab}}-T_\ell\right)\times K$$

$$T_{up}=\left(\frac{2.8\times10^{-2}\times1800}{9.55\times2.0}-2.45\right)\times3.0\fallingdotseq0.57\,[\mathrm{N\cdot m}]$$

Descending

$$T_{DOWN}=\left(\frac{J_B\times n}{9.55\times t_{ab}}+T_\ell\right)\times K$$

$$T_{DOWN}=\left(\frac{2.8\times10^{-2}\times1800}{9.55\times2.0}+2.45\right)\times3.0\fallingdotseq15.3\,[\mathrm{N\cdot m}]$$

Since the result of the above shows that required torque is 15.3 [N•m], check the specifications in the catalog and select size 12 (dynamic friction torque of 16.0 [N•m]) of the BXL models of brakes for braking.

■ Consideration of Energy

Confirm that the brake selected based on required torque satisfies the required specifications for number of braking operations and braking frequency.

- Calculating the total moment of inertia J

  Adding the inertial moment converted to brake shaft inertial moment J_B that was just calculated to the inertial moment of the rotating parts of the provisionally selected BXL-12 (catalog value of 33.75 × 10^{-5}), we arrive at the total moment of inertia.

$$J = 2.8\times10^{-2}+33.75\times10^{-5}$$
$$\fallingdotseq 2.83\times10^{-2}[\mathrm{kg\cdot m^2}]$$

- Calculating the amount of energy required for one braking operation E_b

  The calculated total moment of inertia is used to calculate the energy required by a single braking operation. Here, the sign of load torque T_ℓ is plus when ascending because the load works in the direction that assists braking and minus when descending because the load works in the direction that hinders braking.

Ascending

$$E_{bup}=\frac{J\times n^2}{182}\times\frac{T_b}{T_b+T_\ell}$$

$$E_{bup}=\frac{2.83\times10^{-2}\times1800^2}{182}\times\frac{16.0}{16.0+2.45}$$

$$\fallingdotseq 437\,[\mathrm{J}]$$

Descending

$$E_{bDOWN}=\frac{J\times n^2}{182}\times\frac{T_b}{T_b-T_\ell}$$

$$E_{bDOWN}=\frac{2.83\times10^{-2}\times1800^2}{182}\times\frac{16.0}{16.0-2.45}$$

$$\fallingdotseq 595\,[\mathrm{J}]$$

- Confirm the frequency S of operations that can be performed per minute

  Substitute the energy required for a single braking E_b calculated above and the allowable braking energy rate $P_{ba\ell}$ for the BXL-12 (catalog value 133.3 W) into the following equation and calculate the frequency S of operations that can be performed per minute.

Ascending

$$S_{up}=\frac{60\times P_{ba\ell}}{E_{bup}}$$

$$S_{up}=\frac{60\times133.3}{437}$$

$$\fallingdotseq 18.3\ [\mathrm{times/min.}]$$

Descending

$$S_{DOWN}=\frac{60\times P_{ba\ell}}{E_{bDOWN}}$$

$$S_{DOWN}=\frac{60\times133.3}{595}$$

$$\fallingdotseq 13.4\ [\mathrm{times/min.}]$$

The desired operation frequency is sufficiently smaller than the calculated operation frequency, so the specification is satisfied. Note that the braking energy rate (catalog value) used in the calculation is the value under ideal conditions, so the desired operation frequency needs to be sufficiently small.

$$13.4\ [\mathrm{times/min.}] \gg 0.1\ [\mathrm{times/min.}]$$

- Calculating the total number of operations (service life)

  Substituting in the just-calculated energy required for a single braking E_b and the BXL-12 total frictional energy E_T (catalog value of 9.0 × 10^7 [J]), we arrive at the total number of operations L.

If the energy of a single cycle of ascending and descending E_b is:

$$E_b=E_{bup}+E_{bDOWN}$$
$$E_b=1032\,[\mathrm{J}]$$

The total number of operations L is:

$$L=\frac{E_T}{E_b}$$

$$L=\frac{9.0\times10^7}{1032}$$

$$\fallingdotseq 87209\ [\mathrm{cycles}]$$

The desired total number of operations is fewer than the calculated total number of operations (service life), so the specification is satisfied.

$$87{,}209\ [\mathrm{cycles}] > 53{,}000\ [\mathrm{cycles}]$$

■ Consideration of Braking Time

Total braking time t_{tb} is calculated as the sum of actual braking time t_{ab}, armature release time t_{ar}, and the initial delay time from start of command input to start of operating input t_{id}.

Here, the actual braking time is expected to be greater in the descending direction, so only the case of descending is considered. The sign of the load torque T_ℓ is minus, since it is in the direction that impedes braking.

$$t_{ab}=\frac{J\times n}{9.55\times(T_b-T_\ell)}$$

$$t_{ab}=\frac{2.83\times10^{-2}\times1800}{9.55\times(16.0-2.45)}$$

$$\fallingdotseq 0.39[\mathrm{s}]$$

Here, the armature release time t_{ar} of the BXL-12 from the catalog is 0.03 [s]. The initial delay time t_{id} is the delay of the operation of relays and the like, so we use 0.025 [s], the typical relay operation time. Thus, the total braking time t_{tb} is:

$$t_{tb}=0.025+0.030+0.39$$
$$\fallingdotseq 0.445\,[\mathrm{s}]$$

■ Consideration of Stopping Precision

When stopping precision (stopping distance) is restricted, calculate stopping precision using the following equations.

$$\theta=6\times n\times(t_{id}+t_{ar}+1/2\times t_{ab})$$
$$=2700[^\circ\ ]$$

The variation in stopping precision--i.e., stopping precision ⊿θ --can be found empirically with the following equation and used as a guide.

$$⊿\theta=\pm0.15\times\theta$$
$$=\pm405[^\circ\ ]$$

This angle is the angle at the brake shaft, so when the stopping precision θ max is 2700 + 405 = 3105 [°] and the drum diameter D_d is 0.5 [m], the braking distance B_d of load W is:

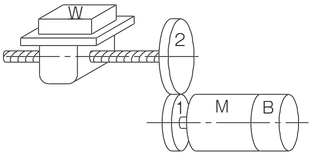
$$B_d=\theta\,\mathrm{max}/360\times R\times\pi\times D_d$$
$$=(3105/360)\times(60/1800)\times\pi\times0.5$$
$$=0.45[\mathrm{m}]$$

If there is no problem with the braking time and stopping precision, BXL-12 can be selected.

BXW/BXR/BXL/BXH Models

Selection Example 2

Holding Brakes Used in Ball Screw Drive of Loads



Selection of a brake to brake the load is as follows, as the above figure illustrates.

Motor (brake shaft) rotation speed	n	1800 [min^{-1}]
Load shaft rotation speed	n_l	900 [min^{-1}]
Moment of inertia of motor	J_M	0.001 [$\text{kg}\cdot\text{m}^2$]
Mass of load	M	500 [kg]
Lead of feed screw	P	0.01 [m]
Shaft diameter of feed screw	D	0.05 [m]
Length of feed screw	l	1 [m]
Friction coefficient of feed screw	μ	0.2

■ Consideration of Torque

The torque required for holding is calculated from the specifications at left, compared to the static friction torque in the catalog, and the appropriate brake size is selected.

- Calculating load torque converted to brake shaft load torque T_ℓ
  Use the following equation to calculate the load torque T_ℓ [N•m]. Here, there is no external force F [N•m], gravitational acceleration g [m/s^2] is 9.8 [m/s^2], R is the ratio of motor rotation speed to load shaft rotation speed, and η is transmission efficiency, which in this selection is 0.85.

$$T_\ell = R \times 1/2\pi \times P \times (F + \mu M_g)/\eta \ [\text{N}\cdot\text{m}]$$

$$T_\ell = (900/1800) \times 1/2\pi \times 0.01 \times (0+0.2\times500\times9.8)/0.85$$

$$\fallingdotseq 0.92[\text{N}\cdot\text{m}]$$

- Calculating the required holding torque T
  Use the following equation to calculate the required holding torque T. Here, safety factor K is 2.

$$T = T_\ell \times K [\text{N}\cdot\text{m}]$$
$$T = 0.92 \times 2$$

$$\fallingdotseq 1.84[\text{N}\cdot\text{m}]$$

Since the result of the above shows that required torque is 1.84 [N•m], check the specifications in the catalog and select size 06 (static friction torque of 4.0 [N•m]) of the BXH models of brakes for holding.

■ Consideration of Energy During Emergency Braking

Brakes selected based on required holding torque are designed primarily for holding, so their braking operations are limited to emergency braking and the like. It is therefore necessary to check that the braking energy per braking operation E_b during emergency braking does not exceed the allowable braking energy $E_{ba\ell}$.

- Calculating the moment of inertia of feed screws

  Given a feed screw whose shaft has a length of 1 [m], diameter of 0.05 [m], and specific gravity of 7.8, the feed screw moment of inertia J_A [kg•m²] is:

$$J_A=\frac{1}{8}\times M\times D^2$$
$$=\frac{1}{8}\times(0.025^2\times\pi\times1\times7.8\times1000)\ \times0.05^2$$
$$≒0.0048[\mathrm{kg}\cdot\mathrm{m}^2]$$

- Calculating the moment of inertia of a linearly moving object

  Use the following equation to calculate the moment of inertia Jx [kg•m²] of a linearly moving object.

$$J_X=J_A+\frac{M\bullet P^2}{4\pi^2}$$
$$=0.0048+\frac{500\times0.01^2}{4\times\pi^2}$$
$$≒6.1\times10^{-3}[\mathrm{kg}\cdot\mathrm{m}^2]$$

- Calculating the total inertial moment converted to brake shaft inertial moment

  The moment of inertia Jx [kg•m²] of a linearly moving object found above is added to the moment of inertia of the rotating parts of the provisionally selected BXH-06 (catalog value of 3.25 × 10^{-5} kg•m²) and the motor's moment of inertia J_M [kg•m²] to calculate the total moment of inertia. Here, R represents the ratio of the motor rotation speed to the load shaft rotation speed.

$$J=J_x\times R^2+J_M+J_B[\mathrm{kg}\cdot\mathrm{m}^2]$$
$$=6.1\times10^{-3}\times\left(\frac{1}{2}\right)^2+0.001+3.25\times10^{-5}$$
$$=2.56\times10^{-3}[\mathrm{kg}\cdot\mathrm{m}^2]$$

- Consideration of energy

  We calculate the braking energy per braking Eb required for emergency braking using the following equation. Here, the brake torque T_b [N•m] is the catalog value of 4.0 [N•m] and the sign of the load torque T_ℓ is plus, since it works in the direction that assists braking.

$$E_b=\frac{J\bullet n^2}{182}\times\frac{T_b}{T_b+T_\ell}$$
$$E_b=\frac{2.56\times10^{-3}\times1800^2}{182}+\frac{4.0}{4.0+0.92}$$
$$≒37.1[\mathrm{J}]$$

Since the calculated braking energy E_b does not exceed the BXH-06's allowable braking energy $E_{ba\ell}$ (catalog value of 700 [J]), the specification is satisfied.

$$37.1\ [\mathrm{J}] < 700\ [\mathrm{J}]$$

■ Consideration of Number of Operations

The total number of braking operations (service life) L when doing emergency braking can be found using the following equation. Here, the BXH-06's total braking energy E_T is the catalog value of 2.0 × 10^6 [J].

$$L=\frac{E_T}{E_b}$$
$$L=\frac{2.0\times10^6}{37.1}$$
$$≒53908\ [\mathrm{times}]$$

With these specifications, BXH-06 can be selected.

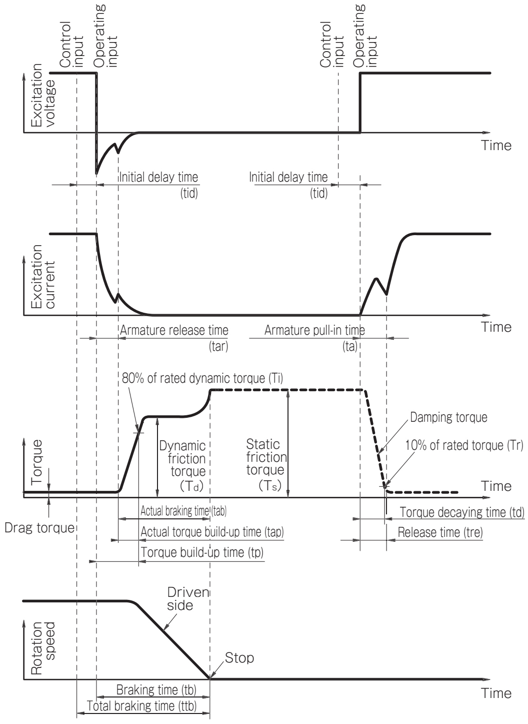
Note that the frequency of emergency braking has a major impact on service life, so it should be about once per minute or better.

COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA
SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BXW
BXR
BXL
BXH
BXL-N

BXW/BXR/BXL/BXH Models

Operating Characteristics

Operating Time



t_{ar}: Armature release time

The time from when current shuts off until the armature returns to its position prior to being pulled in and torque begins to be generated

t_{ap}: Actual torque build-up time

The time from when torque first begins to be generated until it reaches 80% of rated torque

t_p: Torque build-up time

The time from when current flow is shut off until torque reaches 80% of rated torque

t_a: Armature pull-in time

The time from when current flow first starts until the armature is pulled in and torque disappears

t_{id}: Initial delay time

The time from start of command input to actuation input or release input to the main brake body

BXW Models

Unit [s]

Type	Voltage	Size	Switching	t_{ar}	t_a
L type (Braking use)	12V	01	DC side	0.015	0.008
	24V	02		0.015	0.008
	45V	03		0.025	0.025
	90V	04		0.030	0.030
	180V	05		0.035	0.035
H type (Holding and braking use)	12V	01	DC side	0.010	0.010
	24V	02		0.010	0.010
	45V	03		0.020	0.035
	90V	04		0.025	0.040
	180V	05		0.030	0.045
S type (Holding use)	24V	01	DC side	0.010	0.025
		02		0.010	0.030
		03		0.020	0.035
		04		0.025	0.040
		05		0.030	0.045
R type (For servo motors)	24V	01	DC side	0.020	0.035
		03		0.020	0.050
		05		0.020	0.060

BXR LE Models（Holding use）

Unit [s]

Voltage	Size	Switching	t_{ar}	t_a
24V	01	DC side	0.020	0.035
	02		0.020	0.050
	03		0.020	0.060

BXR Models (Holding use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_a
24V	06	DC side	0.02	0.05
	08		0.02	0.08
	10		0.05	0.11
	12		0.03	0.12
	14		0.03	0.12
	16		0.10	0.22

BXL Models (Braking use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_{ap}	t_p	t_a
24V 45V 90V	06	DC side	0.020	0.015	0.035	0.035
	08		0.020	0.015	0.035	0.040
	10		0.025	0.020	0.045	0.050
	12		0.030	0.025	0.055	0.070
	16		0.035	0.030	0.065	0.100
45V 90V	06	AC side	0.110	0.035	0.145	0.035
	08		0.110	0.040	0.150	0.040
	10		0.150	0.060	0.210	0.050
	12		0.180	0.095	0.275	0.070
	16		0.180	0.100	0.280	0.100

BXH Models (Holding use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_a
24V 45V 90V	06	DC side	0.020	0.040
	08		0.020	0.045
	10		0.025	0.070
	12		0.025	0.090
	16		0.030	0.125
45V 90V	06	AC side	0.070	0.040
	08		0.080	0.045
	10		0.090	0.070
	12		0.120	0.090
	16		0.140	0.125

BXL-N Models (Braking use)

Unit [s]

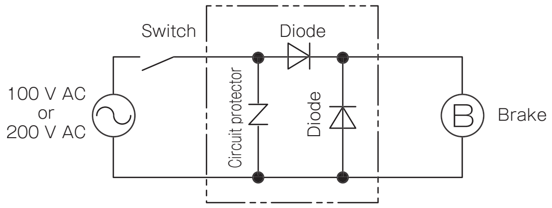
Voltage	Size	Switching	t_{ar}	t_a
24V 99V 171V	08-10N-002	DC side	0.050	0.030
	08-10N-004		0.040	0.040
	10-10N-008		0.050	0.050
	10-10N-015		0.030	0.070
	12-10N-022		0.060	0.080
	12-10N-030		0.030	0.100
	16-10N-040		0.070	0.100
	16-10N-060		0.050	0.100
	16-10N-080		0.030	0.100

Control Circuits

45 V, 90 V, and 96 V Specifications for BXW, BXR, BXL, and BXH Models (Single-phase Half-wave Rectified)

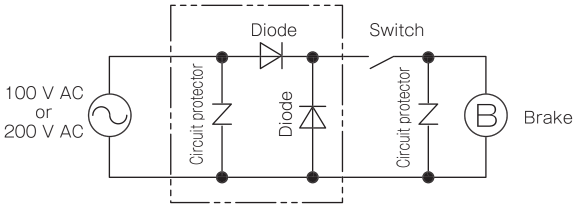
■ AC-side Switching

This is the usual switching method. Connection is simple.



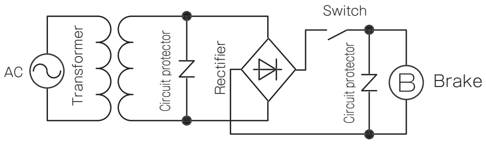
■ DC-side Switching

This method achieves even faster operational characteristics than AC-side switching.



12 V and 24 V Specifications for BXW, BXR, BXL, and BXH Models (Single-phase Full-wave Rectified)

■ DC-side Switching



■ Circuit Protectors

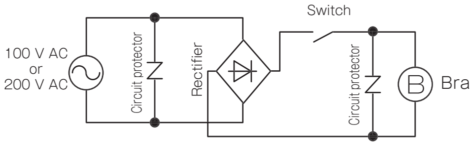
If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake. However, with some circuit protectors, operation times may lengthen. In such cases, we recommend use of varistors.
Select varistors from the following table based on brake size and AC voltage before rectification.
Note that the 24 V specifications of BXL and BXH as well as all BXR models are supplied with varistors. See Included varistors for each model.

Brake size	Pre-rectification voltage [V]	Recommended varistor model
01 ～ 18	AC 30 or below	NVD07SCD082 or an equivalent
	Over AC 30 to AC 110 or below	NVD07SCD220 or an equivalent
	Over AC 110 to AC 220 or below	NVD07SCD470 or an equivalent
	Over AC 220 to AC 460 or below	NVD14SCD820 or an equivalent
20 ～ 25	AC 30 or below	NVD14SCD082 or an equivalent
	Over AC 30 to AC 110 or below	NVD14SCD220 or an equivalent
	Over AC 110 to AC 220 or below	NVD14SCD470 or an equivalent
	Over AC 220 to AC 460 or below	NVD14SCD820 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.

90 V, 96 V, 180 V, and 190 V Specifications for BXW Models (Single-phase Full-wave Rectified)

■ DC-side Switching

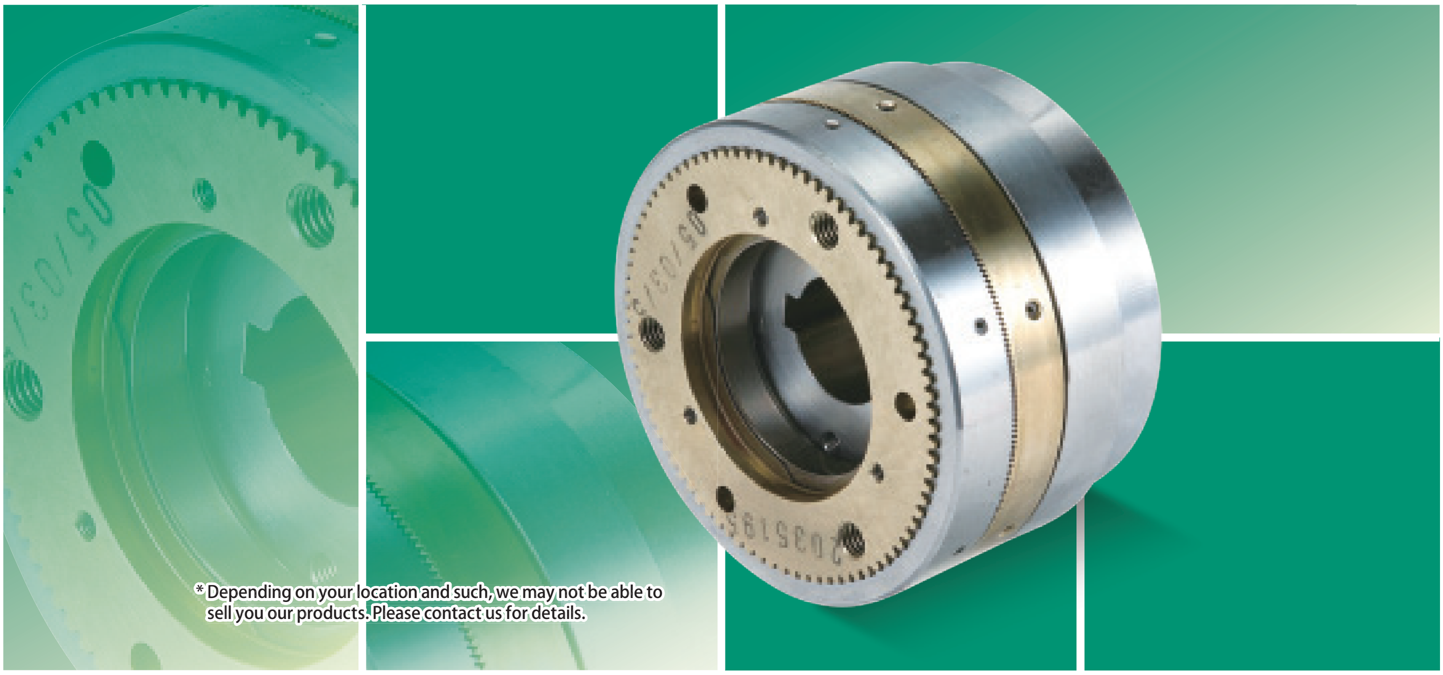


ELECTROMAGNETIC TOOTH CLUTCHES

Application Printing machinery, wrapping machinery, filling machinery, food machinery, medical machinery

Meshing-type Electromagnetic-actuated Clutch Has High Torque and Reliable Transmission

These electromagnetic tooth clutches are electromagnetic-actuated clutches of the type that transmit torque by engaging tooth. Since torque is transmitted by engaging tooth, these clutches can transmit very high torque with a compact size (five to ten times our dry-type single discs). They may be either full position, which engage everywhere around their circumference, or single position, which engage at a set position, engaging in only one location per revolution. The shape of the tooth tip may be either symmetrical or sawtooth. Symmetrical tips can be used in any rotation direction, while sawtooth tips are faster than symmetrical tips and can engage at higher speeds.



* Depending on your location and such, we may not be able to sell you our products. Please contact us for details.

Compact, high torque

Since torque is transmitted by the meshing of the tooth, high torque transmission can be achieved with a compact form factor.

No drag torque

Since the tooth do not form a magnetic circuit, engagement and release can be faster, and there is no drag torque.

Easy mounting

Bearings are built in, so there is no centering of stator and rotor.

Can be used in oily environments

Can be used in oily environments under some usage conditions.

Special position engagement

Special tooth shapes can be made that mesh at multiple locations.

Available Models

Series	Tooth Shapes	Positions	Lineup
TOOTH CLUTCHES	Full-depth tooth	Full position	546- □ -34-NF
		Single position	546- □ -34-NS
	Sawtooth (right rotation)	Full position	546- □ -34-RF
		Single position	546- □ -34-RS
	Sawtooth (left rotation)	Full position	546- □ -34-LF
		Single position	546- □ -34-LS

Tooth Shape/Construction

Full-depth Tooth

By far the most common tooth shape, it can be used rotating in either direction.

Sawtooth

These have fewer tooth that the full-depth tooth type, and have a smaller angle of mesh insertion. They can thus engage at a relatively higher speed than full-depth tooth.

Full Position

A common tooth shape that can mesh anywhere around the full circumference.

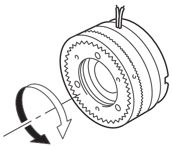
Single Position

This tooth shape is for fixed position engagement, where only one location meshes per revolution.

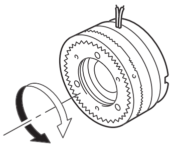
Name of tooth shape	NF	NS	RF	RS	LF	LS
Type of tooth shape	Full-depth tooth	Full-depth tooth	Sawtooth	Sawtooth	Sawtooth	Sawtooth
Position	Full	Single	Full	Single	Full	Single
Rotational direction	Both	Both	Right	Right	Left	Left

* The reference point for rotation direction (rotor) is the direction as seen from the adapter plate. With armature input, the rotation direction is as stated. Note that with shaft input, the direction is the opposite.
Example: To get right rotation at shaft input, use a left-rotating sawtooth (L).

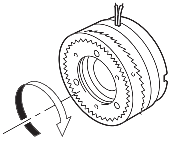
[NF]
Full-depth tooth,
full-position



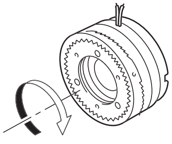
[NS]
Full-depth tooth,
single-position



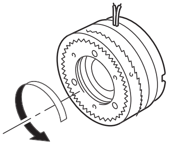
[RF]
Right-handed
rotating sawtooth,
full-position



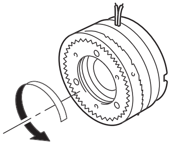
[RS]
Right-handed
rotating sawtooth,
single-position

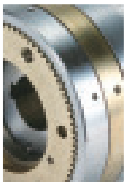


[LF]
Left-handed
rotating sawtooth,
full-position



[LS]
Left-handed
rotating sawtooth,
single-position





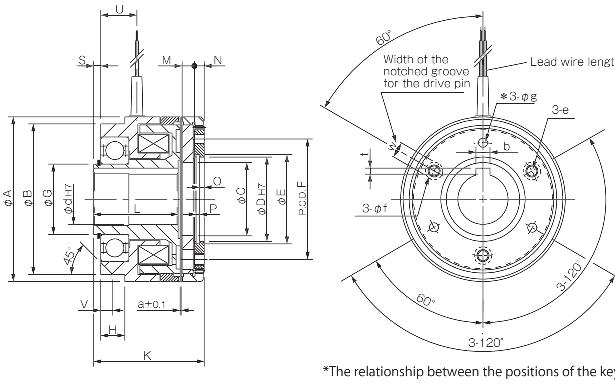
546 Models

Specifications

Model	Size	Torque [N·m]	Coil (at 20℃)				Heat resistance class	Allowable rotation speed of engagement [min⁻¹]			Max. rotation speed [min⁻¹]	Moment of inertia J [kg·m²]		Number of teeth		Armature pull-in time ta [s]	Armature release time tar [s]	Mass [kg]
			Exciting voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]		NF	NS	Sawtooth		Rotor	Armature	Full-depth tooth, Full	Sawtooth, Full			
546-12-34	12	17.5	DC24	13.3	0.55	44.0	F	50	30	100	1500	6.6×10^{-5}	6.0×10^{-5}	200	25	0.035	0.040	0.5
546-13-34	13	25	DC24	18.7	0.78	31.0	F	50	30	100	1500	1.5×10^{-4}	1.2×10^{-4}	220	30	0.040	0.050	0.9
546-15-34	15	50	DC24	21.3	0.89	27.1	F	50	30	100	1500	3.7×10^{-4}	3.7×10^{-4}	260	36	0.060	0.060	1.5
546-21-34	21	100	DC24	27.0	1.13	21.0	F	50	30	100	1500	8.7×10^{-4}	5.2×10^{-4}	290	36	0.080	0.070	2.4
546-23-34	23	250	DC24	36.2	1.51	15.9	F	50	30	100	1500	2.06×10^{-3}	1.85×10^{-3}	280	38	0.090	0.080	3.9
546-25-34	25	500	DC24	56.6	2.36	10.2	F	50	30	100	1500	4.88×10^{-3}	4.51×10^{-3}	250	40	0.100	0.090	6.8
546-31-34	31	1000	DC24	79.7	3.32	7.2	F	50	30	100	1500	1.12×10^{-2}	1.28×10^{-2}	195	40	0.110	0.110	11.1
546-32-34	32	2200	DC24	114.0	4.75	5.1	F	50	30	100	1500	2.87×10^{-2}	2.92×10^{-2}	186	40	0.120	0.130	15.3

* The armature pull-in and release times are reference values under no load in a stationary state. They are generally longer depending on the size of the load and the operating state when engaged.
* The allowable rotation speeds of engagement NF and NS indicate, respectively, full-depth tooth/full position and full-depth tooth/single position.

Dimensions



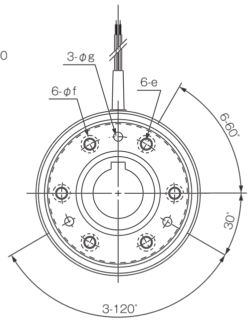


Diagram of mounting bore positions for size 31 and size 32

*The relationship between the positions of the keyway and mounting bore will differ from that shown in the diagram while the parts are fitted together.
*The dimension φg marked with [*] does not apply for size 12.

Unit [mm]

Size	d H7	Shaft bore dimensions			
		Models compliant with the new JIS standards		Models compliant with the old JIS standards	
		b P9	t $^{+0.5}_{0}$	b E9	t $^{+0.5}_{0}$
12	10	$3\,^{-0.006}_{-0.031}$	1.2	$4\,^{+0.05}_{+0.02}$	1.5
13	15	$5\,^{-0.012}_{-0.042}$	2	$5\,^{+0.05}_{+0.02}$	2
15	20	$6\,^{-0.012}_{-0.042}$	2.5	$5\,^{+0.05}_{+0.02}$	2
	25	$8\,^{-0.015}_{-0.051}$	3	$7\,^{+0.061}_{+0.025}$	3
21	25	$8\,^{-0.015}_{-0.051}$	3	$7\,^{+0.061}_{+0.025}$	3
	30	$8\,^{-0.015}_{-0.051}$	3	$7\,^{+0.061}_{+0.025}$	3
23	30	$8\,^{-0.015}_{-0.051}$	3	$7\,^{+0.061}_{+0.025}$	3
	40	$12\,^{-0.018}_{-0.061}$	3	$10\,^{+0.061}_{+0.025}$	3.5
25	40	$12\,^{-0.018}_{-0.061}$	3	$10\,^{+0.061}_{+0.025}$	3.5
	50	$14\,^{-0.018}_{-0.061}$	3.5	$12\,^{+0.075}_{+0.032}$	3.5
31	50	$14\,^{-0.018}_{-0.061}$	3.5	$12\,^{+0.075}_{+0.032}$	3.5
	60	$18\,^{-0.018}_{-0.061}$	4	$15\,^{+0.075}_{+0.032}$	5
32	60	$18\,^{-0.018}_{-0.061}$	4	$15\,^{+0.075}_{+0.032}$	5
	70	$20\,^{-0.022}_{-0.074}$	4.5	$18\,^{+0.075}_{+0.032}$	6

Unit [mm]

Model	Radial direction dimensions										Axial direction dimensions											
	A	B	C	D	E	F	G	e	f	g	H	K	L	M	N	O	P	S	U	V	W	a
546-12-34	57	52	22.5	26	27.2	36	20	M4	8.5	—	10	43	34	4.3	3.1	1.3	1.3	2.0	15	4.5	5	0.2
546-13-34	67	58	31	32	33.7	46	25	M5	8.5	4.5	11	49	39	4.9	3.5	1.4	1.3	2.5	16.5	5	6	0.3
546-15-34	82	75	36.5	42	44.5	60	35	M6	10	4.5	12	55	42	6.1	4.8	2.2	1.9	3.5	18	6	8	0.3
546-21-34	95	88	46	52	55	70	45	M8	12	5.5	14	63	45	8.7	6.0	2.8	2.2	3.0	20	6	10	0.4
546-23-34	114	105	55	62	65	80	55	M8	12	7.8	18	69	50	9.0	6.5	3.3	2.2	3.0	24	6	10	0.4
546-25-34	134	127	68	72	75	95	70	M12	15	9.5	20	83	61	11.0	8.4	4.3	2.7	3.0	26	8	10	0.4
546-31-34	166	152	80	90	93.5	120	85	M12	15	9.5	22	93.5	66	13.1	11.4	5.3	3.2	3.5	31	10	12	0.5
546-32-34	195	175	95	100	103.5	150	100	M12	19	11.5	24	110	80	14.0	11.7	6.3	3.2	4.0	38.5	10	12	0.5

How to Place an Order

546-12-34-NF 24V 10DIN

Size

Keyway standards
DIN: Compliant with the new JIS standards
JIS: Compliant with the old JIS standards

Rotor bore diameter (dimensional symbol d)

Tooth shape
NF: Full-depth tooth, full-position
RF: Right-handed rotating sawtooth, full-position
LF: Left-handed rotating sawtooth, full-position
NS: Full-depth tooth, single-position
RS: Right-handed rotating sawtooth, single-position
LS: Left-handed rotating sawtooth, single-position

*Depending on your location and such, we may not be able to sell you our products. Please contact us for details.

Selection

When Found from Motor Output

The clutch-shaft conversion of motor torque (TM) is:

$$T_M = \frac{9550 \cdot P}{n_r} \cdot \eta \ [\text{N•m}] \cdots\cdots (1)$$

P: Motor output [kW]
n: Clutch-shaft conversion of rotation speed [min^{-1}]
η : Transmission efficiency from motor to clutch

The required torque (T) when the motor is correctly selected for the load is:

$$T = T_M \text{•} K \ [\text{N•m}] \cdots\cdots (2)$$

K: Safety factor

When Load Rotation Starts After Engagement

The acceleration torque (TA) for starting up within n rotations is:

$$T_A = \frac{J \cdot n}{9.55 \cdot t_A} \ [\text{N•m}] \cdots\cdots (3)$$

J: Total moment of inertia on load side [kg·m^2]
t_A: Acceleration time [s]

Therefore, the required torque (T) is:

$$T = (T_L + T_A)\ K\ [\text{N•m}] \cdots\cdots (4)$$

T_L: Load torque [N•m]

Select the clutch size by searching the specification table for the clutch whose value adequately satisfies the required torque (T).

Safety factor: K

Load state	Factor
Low rotation speed/small torque fluctuation	1.5
Ordinary load/small torque fluctuation	2
High rotation speed/large torque fluctuation	3

Recommended Power Supplies and Accessory Parts

Model	Recommended power supplies	Accessory parts	
		Circuit protector (Varistor), qty. 1	Shims (Inner diameter × Outer diameter × Thickness), qty. 5 [mm]
546-12-34-□ 24V 10□	BES-20-51 • BEH-10G	NVD07SCD082 or an equivalent	10.3 × 13.7 × 0.1t
546-13-34-□ 24V 15□	BES-20-51 • BEH-10G	NVD07SCD082 or an equivalent	15.3 × 20.7 × 0.1t
546-15-34-□ 24V 20□	BES-20-51 • BEH-10G	NVD07SCD082 or an equivalent	20.3 × 27.7 × 0.1t
546-15-34-□ 24V 25□	BES-20-51 • BEH-10G	NVD07SCD082 or an equivalent	25.3 × 34.7 × 0.1t
546-21-34-□ 24V 25□	BES-20-52 • BEH-10G	NVD07SCD082 or an equivalent	25.3 × 34.7 × 0.1t
546-21-34-□ 24V 30□	BES-20-52 • BEH-10G	NVD07SCD082 or an equivalent	30.3 × 41.7 × 0.1t
546-23-34-□ 24V 30□	BES-20-52 • BEH-10G	NVD07SCD082 or an equivalent	30.3 × 41.7 × 0.1t
546-23-34-□ 24V 40□	BES-20-52 • BEH-10G	NVD07SCD082 or an equivalent	40.3 × 51.7 × 0.1t
546-25-34-□ 24V 40□	BES-20-52 • BEH-20G	NVD07SCD082 or an equivalent	40.3 × 51.7 × 0.1t
546-25-34-□ 24V 50□	BES-20-52 • BEH-20G	NVD07SCD082 or an equivalent	50.3 × 61.7 × 0.1t
546-31-34-□ 24V 50□	BES-40-53 • BEH-20G	NVD14SCD082 or an equivalent	50.3 × 61.7 × 0.1t
546-31-34-□ 24V 60□	BES-40-53 • BEH-20G	NVD14SCD082 or an equivalent	60.3 × 71.1 × 0.1t
546-32-34-□ 24V 60□	BES-40-53 • BEH-20G	NVD14SCD082 or an equivalent	60.3 × 71.1 × 0.1t
546-32-34-□ 24V 70□	BES-40-53 • BEH-20G	NVD14SCD082 or an equivalent	70.3 × 79.7 × 0.1t

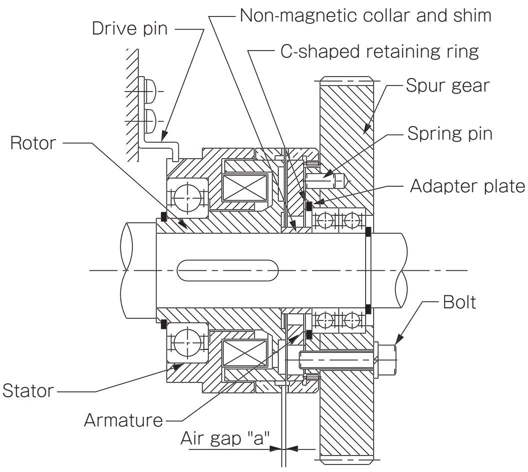
* NVD□SCD□ parts are manufactured by KOA Corporation.
* Varistors need not be used when a BES/BEH model recommended power supply is used. For details, refer to the section on power supplies.

546 Models

Items Checked for Design Purposes

Precautions for Mounting

This clutch is mounted for a through-shaft. The mounting example shown below is for mounting on an ordinary through-shaft.



❶ Set the air gap between the teeth tips on the rotor and armature sides so that it is the value “a” in the dimensions table. Shims may be used to facilitate setting of the air gap.

❷ Use a collar made of a non-magnetic material (such as stainless steel or brass) to set the air gap. Use the reference values of the table below for the length of the collar when centering bearings relative to the adapter plate.

Collar lengths when using bearings to center

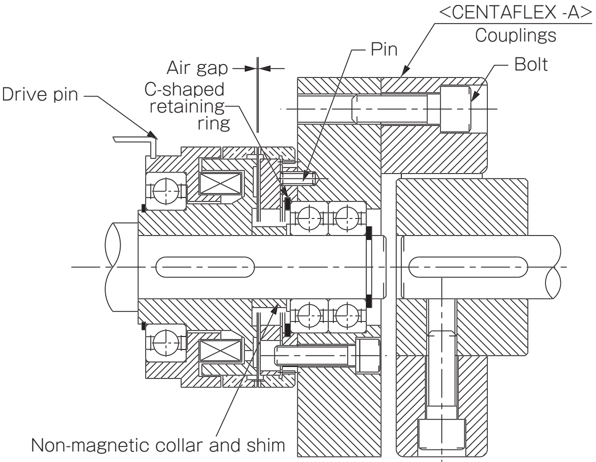
Size	Dimensions [mm]	Size	Dimensions [mm]
12	7.3	23	15.5
13	8.3	25	17.5
15	10.5	31	22.0
21	15.0	32	23.5

* Process the collar length to the negative tolerance and then make fine adjustments with shims.
* Five shims (0.1 mm in thickness) are provided for each shaft bore diameter.
* If not using the bearing to center, use a different collar design.

❸ When mounting, lock it securely in the axial direction so that there is no play (rattle) in the axial direction.

❹ We recommend a tolerance of h6 or j6 for the shaft when mounting.

❺ This clutch is for through-shafts; when using it on butt shafts, align one of the shafts with a bearing. Using a MIKI PULLEY CENTAFLEX coupling makes it relatively easy to find the centers. See the mounting examples below.



❻ The inner diameter of the adapter plate is the same as the outer diameter of the ball bearing, so the center is easy to find when designed to directly press in the ball bearings.

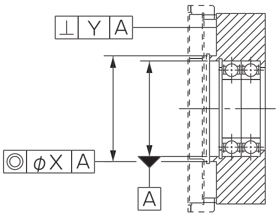
Recommended bearings when inner diameter of adapter plate is used as centering mark

Size	Bore diameter ød [mm]	Centering dimension øD [mm]	Bearing
12	10	26	6000
13	15	32	6002
15	20	42	6004
15	25	42	6905
21	25	52	6205
23	30	62	6206
23	40	62	6908
25	50	72	6910
31	50	90	6210
32	70	100	6914

Ball bearings cannot be used as centering points for combinations of the sizes and shaft diameters at right; in such cases, install centering positions on the flange (gear, sprocket, or the like) on which the adapter plate is mounted and then find the centers. Use the following as a reference for the precision of the mounting surface of the armature (adapter plate).

Size	Bore diameter ød [mm]	Centering dimension øD [mm]
21	30	52
25	40	72
31	60	90
32	60	100

Armature (adapter plate) mounting surface precision

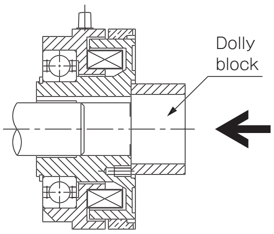


Size	X [mm]	Y [mm]
12	0.04	0.03
13	0.05	0.04
15	0.05	0.04
21	0.06	0.05
23	0.07	0.05
25	0.08	0.06
31	0.08	0.07
32	0.10	0.08

❼ Use two ball bearings in the flange (gear, sprocket, or the like) on which the armature (adapter plate) is mounted so that no vibration is generated in the armature.

❽ A pilot bore for mounting the spring pin has been drilled in the adapter plate. (This does not apply to size 12.) Although in some conditions its use can be omitted, we recommend that after the flange (gear, sprocket, or the like) that mounts on the adapter plate is mounted, additional processing gauged against actual objects be performed and spring pins be concurrently used. (Concurrent use of spring pins is not necessary for size 12.) For details, see the section on assembly of the armature part.

❾ Apply a small amount of adhesive to stop loosening to the bolt that mounts the adapter plate on the gear, sprocket, or the like.



❿ When inserting the stator side onto the shaft, damage can result from strong pounding with a hammer or pushing on the outer circumference part. Press a pipe-shaped dolly block near the shaft bore of the boss part and carefully insert it. The material is soft, so do not bend it as you insert.

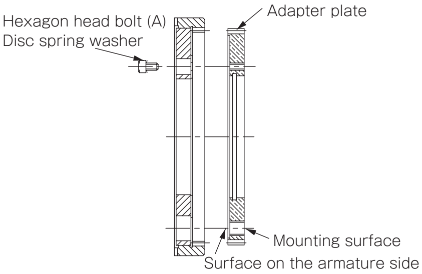
⓫ Hold the stator only in the direction of rotation, using the cut-out for stopping rotation. Be careful not to apply pressure on the cut-out in the shaft direction at this time.

⓬ We recommend applying lubricant (molybdenum disulfide grease) to the teeth tips to improve the wear resistance of the teeth tips.

⓭ Hold it so that no force is applied that might pull on or damage leads.

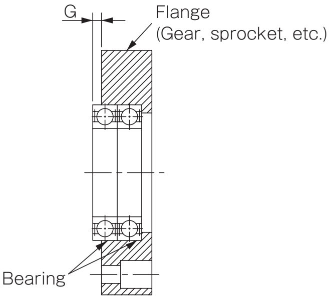
Assembly of Armature Components

❶ Remove the hexagon head bolt [A] previously fixed in place from the armature side and separate the armature and adapter plate. At this time, make fitting marks with a marker to show where the armature and adapter plate fit together to facilitate re-assembly.



❷ Press-fit the bearing onto the flange (gear, sprocket, etc.). If there are bearing centering marks, use a flange design that results in the bearing projection (dimension G) being the value in the table below.

Bearing projection



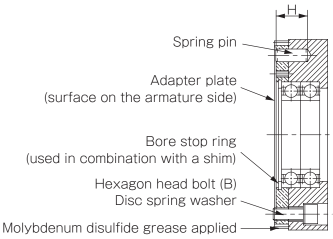
Unit [mm]

Size	Dimension G
12	1.3
13	1.4
15	2.2
21	2.8
23	3.3
25	4.3
31	5.3
32	6.3

* When press-fitting a bearing, apply bearing mount (adhesive) to the outer circumference of the bearing.
* Finish the depth of the bearing insertion bore to the positive tolerance (we recommend 0 to +0.1) and adjust with shims so there is no play (rattle) in the thrust direction.

❸ Snap the C-shaped snap ring in the C-shaped snap ring groove of the adapter plate. Use shims to adjust the air gap between the bearing and snap ring (for rattle).

❹ Mount the adapter plate on the flange and tighten the hexagon head bolt (B) to secure it.



* Pay attention to the orientation of the adapter plate.
* Apply a small amount of adhesive to the hexagon head bolt.
* See the table below for the hexagon head bolt tightening torque.

Adapter plate mounting bolt tightening torque

Size	Bolt	Tightening torque [N·m]	
		When spring pin is used	When no spring pin is used
		Bolt strength category 8.8 or higher	Bolt strength category 10.9 or higher
12	3-M4	–	3.4
13	3-M5	5.2	7.0
15	3-M6	8.8	11.8
21	3-M8	22.0	29.5
23	3-M8	22.0	29.5
25	3-M12	77.0	104.0
31	6-M12	77.0	104.0
32	6-M12	77.0	104.0

❺ Use the adapter plate's pilot bore for pins to simultaneously drill the spring pin bore. (Burr must be removed.) Consult the following table's recommended bore drilling dimensions for spring pin parts when drilling pin bores.

Recommended bore drilling dimensions for spring pin parts

Unit [mm]

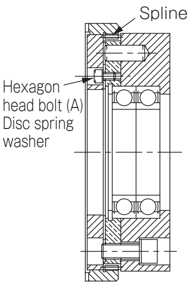
Size	Bore drilling dimension	Recommended depth H	Spring pin
13	$5^{+0.12}_{0}$	13	5 × 10
15	$5^{+0.12}_{0}$	13	5 × 10
21	$6^{+0.12}_{0}$	15	6 × 12
23	$8^{+0.15}_{0}$	19	8 × 16
25	$10^{+0.15}_{0}$	21	10 × 18
31	$10^{+0.15}_{0}$	25	10 × 22
32	$13^{+0.2}_{0}$	25	13 × 22

* Recommended depth H includes the adapter plate drilling margin.

❻ Hammer a spring pin into the bore drilling site.
Hammer in the spring pin with the indexing direction facing the outer circumference (spline side). When doing so, be careful that the pin does not extend beyond the adapter plate surface. Have spring pins ready that meet the specifications of the table above.

❼ Completely remove any dust, powder or the like produced by bore drilling and wipe the spline part with molybdenum disulfide grease.

❽ Insert the adapter plate back onto the armature using the fitting marks previously drawn, and fasten with the hexagon head bolt [A] that you removed. (Do not use adhesives.) See the table below for the tightening torque.



Size	Bolt	Tightening torque [N·m]
12	M3 × 3	1.5
13	M3 × 4	1.5
15	M3 × 4	1.5
21	M4 × 6	3.4
23	M4 × 6	3.4
25	M4 × 8	3.4
31	M5 × 10	7.0
32	M6 × 10	11.8

Precautions for Use

❶ Tooth will not mesh together if the inertia on the driven side is too great. In such cases, we recommend lowering the rotation speed or also using a CENTAFLEX coupling to absorb shock.

❷ With single position tooth shapes, drag torque will be generated by contact between tooth tips until the tooth reach their engaging position after pull-in. Tooth clutches are structured, however, so the tooth do not form a magnetic circuit, meaning that drag torque is low and hardly ever a problem. When load torque is very small compared to clutch torque, however, drag turning may occur on the driven side. In such cases, a brake must also be used, to prevent drag turning.

❸ The keyway cannot be aligned with the adapter plate mounting holes in the engaging position. When alignment is necessary, adjust position with the paired side elements of the clutch.

❹ When used in stationary engagement, teeth may fail to engage and come into contact with other tooth tips when pull-in occurs. Rotation in this condition may result in teeth slipping rather than engaging, so adjust the acceleration speed of the drive side to engage.

❺ The operating power supply of the clutch is DC 24 V. Keep fluctuations of the applied voltage within -10% to +5%. Since optimal BES model power supplies are available for the tooth clutch, we recommend one of these be used for both.

❻ Install a switch on the DC side to turn the clutch on and off. Operating times will be slower if it is installed on the AC side. A varistor to protect contacts should also be connected in parallel to the clutch.

BRAKE MOTORS

Application	Printing machinery, bookbinding machinery, food machinery, wrapping machinery, medical machinery

Induction Motors with Integrated Brakes

Brake motors incorporate an internal electromagnetic-actuated brake or spring-actuated brake without changing the dimensions of the induction motor. A compact power supply for the brake is built into the terminal box, so the brake motor can be simply connected and used. Choose from either base-mounted or flange-mounted types.

Same dimensions as induction motor

Since the brake is incorporated without changing the dimensions of the induction motor, mounting is easy.

Long service life

The large frictional surface area provides a long service life.

Built-in power supply

A small power supply is included in the product and handling is easy.

Quiet running (BMS models)

The rotating part (disc) is completely integrated into the motor shaft, so operation is quiet.

Manual release (BMS models)

The braking/holding state can be manually released using a release lever.

Stable rapid braking (BMM models)

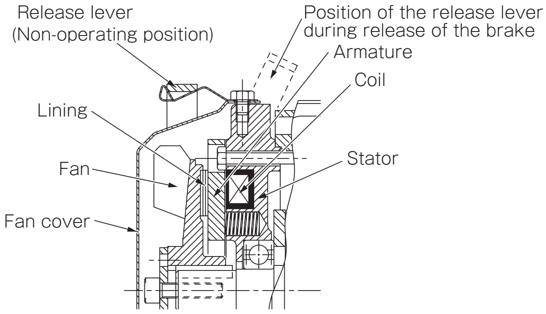
Torque is transmitted by a constant-load spring, enabling stable and rapid braking.

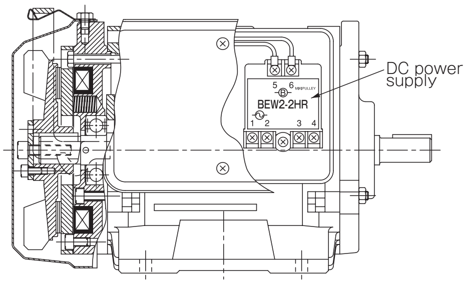
Available Models

	Model	Base-mounted	Flange-mounted	Motor output [kW]								
				0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Spring-actuated	**BMS**	●	●	●	●	●	●	—	—	—	—	—
Electromagnetic-actuated	**BMM**	●	●	●	●	●	●	●	●	▲	▲	▲

Structure

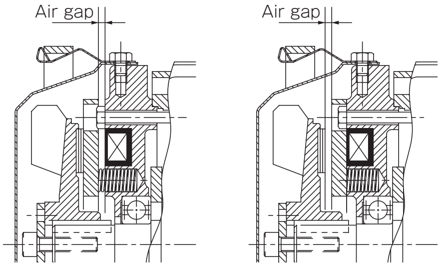
BMS Construction





BMS Operating Principles

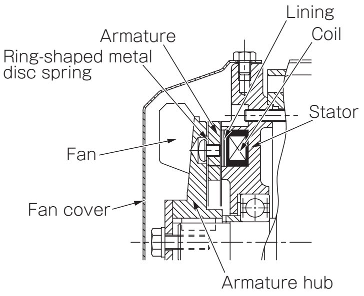
These brakes are spring actuated type brakes. When the power is turned on, the stator is magnetized simultaneous with the motor, and the generated attraction force pulls the armature to the stator, overcoming the pressure of the torque spring. An air gap between the disc and armature is created at that time, the brake is fully released, and the motor shaft rotates. When the current is shut off, the magnetic attraction force of the stator is extinguished, the armature is pushed back by the force of the torque spring, braking force is applied to the disc, and the motor shaft rapidly stops.

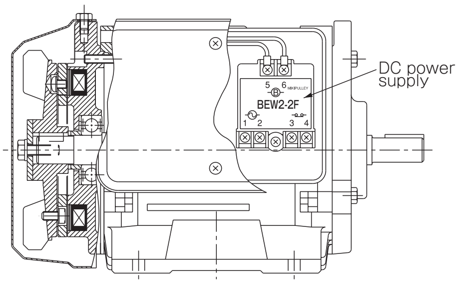


Brake activated when shielded

Brake released when energized

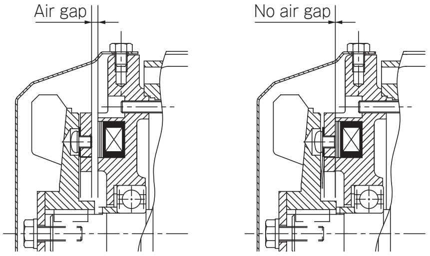
BMM Construction





BMM Operating Principles

These brakes are electromagnetic actuated type brakes. When current flows to the coil, the stator is magnetized and the armature is pulled in. Frictional force working between the lining and armature then generates the braking torque of the brake. When the current is shut off, the armature is pulled back by the ring-shaped metal disc spring located between the armature and hub, and the lining and armature are instantly released.



Brake released when shielded

Brake activated when energized

BMS Models Spring-actuated Brake Motors

Specifications

Model	Motor		Brake									Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T [J]	Operating time			Mass [kg]
	Frame No.	Output [kW] 4-poles	Torque T [N·m]	Coil (at 20℃)				Heat resistance class	Air gap						Armature pull-in time t_a [s]	Coastdown time		
				Voltage [V]	Current [A]	Resistance [Ω]	Wattage [W]		Control value [mm]	Limit value [mm]						Simultaneous off [s]	DC off separately [s]	
BMS-024-NHBN BMS-024-NHFN	63	0.2	2	DC90	0.20	440	18	B	0.15 ～ 0.25	0.40	0.8 × 10^{-3}	18	3.5 × 10^{7}	0.04	0.1	0.08	7.5 8.5
BMS-044-NHB BMS-044-NHF	71	0.4	4	DC90	0.28	324	25	B	0.15 ～ 0.25	0.40	1.5 × 10^{-3}	26.2	7.0 × 10^{7}	0.05	0.1	0.08	10 11
BMS-074-HPB BMS-074-HPF	80	0.75	8	DC90	0.33	270	30	B	0.20 ～ 0.30	0.50	4.3 × 10^{-3}	29.4	12.5 × 10^{7}	0.05	0.14	0.09	16.5 19
BMS-154-HPB BMS-154-HPF	90	1.5	15	DC90	0.34	261	31	B	0.20 ～ 0.30	0.60	8.1 × 10^{-3}	45.8	20.0 × 10^{7}	0.11	0.15	0.09	23 26

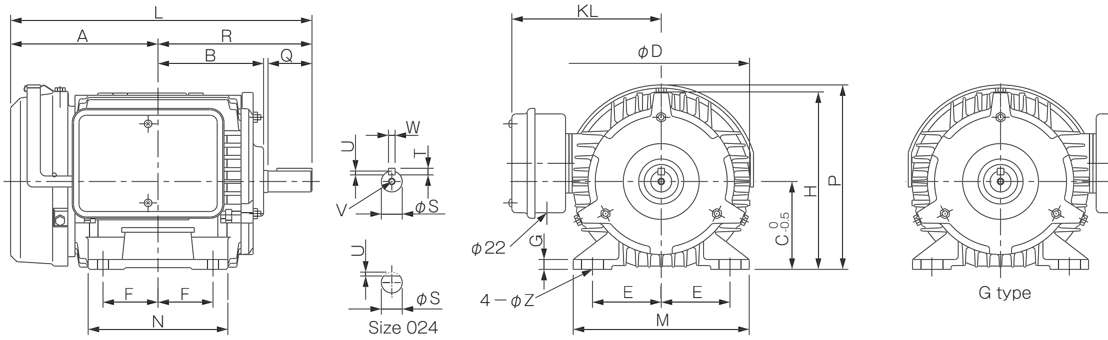
* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher). (made by Hitachi Industrial Equipment Systems)

* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.

* See P.377 for the allowable braking frequency of brake motors. The specific frequency varies with load conditions, so confirm it in your selection calculations.

Dimensions

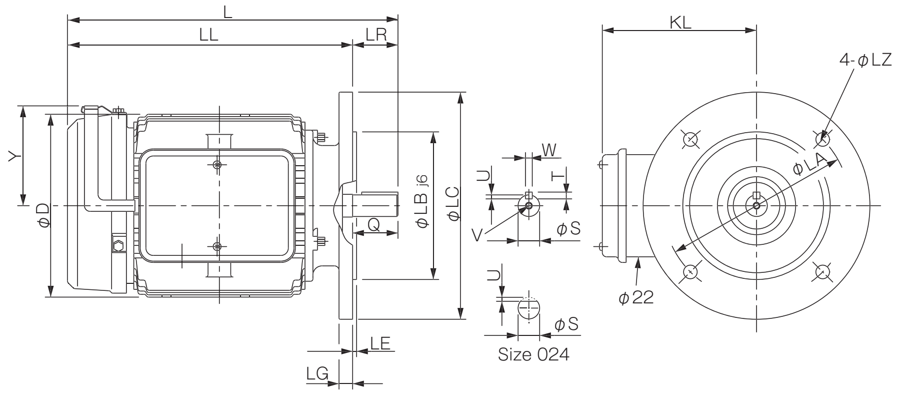
Base-mounted



Unit [mm]

Model	Dimensions of part																			
	L	R	A	B	D	KL	H	P	C	F	E	N	M	G	Z	S	W	U	T	Q	V
BMS-024-NHBN	215	103	112	79	130	115	128	134	63	40	50	100	130	3.2	7 × 21	11 h6	─	1	─	23	─
BMS-044-NHB	244	120	124	87	145	141	143.5	150	71	45	56	115	140	3.2	7 × 20	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMS-074-HPB	290.5	140	150.5	97	163	148	161.5	168	80	50	62.5	125	160	3.2	10 × 25	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMS-154-HPB	329	168.5	160.5	114.5	182	144	178	188	90	62.5	70	155	170	10	10	24 j6	8	4	7	50	M6 × 1, length: 20

Flange-mounted



Unit [mm]

Model	Dimensions of part																
	L	LR	LL	D	KL	LC	Y	LB	LA	LE	LG	LZ	S	W	U	T	Q	V
BMS-024-NHFN	241	23	218	130	115	160	70	110	130	3.5	8	10	11 h6	─	1	─	23	─
BMS-044-NHF	265	30	235	145	134.5	160	79	110	130	3.5	10	10	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMS-074-HPF	305	40	265	163	142	200	88	130	165	3.5	12	12	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMS-154-HPF	349	50	299	176	144	200	98	130	165	3.5	12	12	24 j6	8	4	7	50	M6 × 1, length: 20

Options and Made to Order

Products with Motor Terminal Box Mounted in Reverse

Option symbol: G

The location where the brake motor is installed may make it impossible to mount the motor's terminal box in the standard location in some cases. In such cases, the mounting dimensions of the G types can be considered. Use the dimensions drawing to check the positions of the terminal boxes on G type motors.

Products with BEW2-2H Brake Rectifiers

Option symbol: 2H

By using a brake motor with an inverter or the like, the motor can be fitted with a power supply that shuts off DC separately (BEW2-2H) when fast response is needed.

List of Accessories

Brake motors come with the components listed at right.
When mounting a V pulley or the like on a brake motor output shaft, the V pulley or the like can be mounted simply on the motor shaft by concurrently using a motor shaft end face tap and the accessories listed at right.
For size 024, the motor output shaft has a flat face, so the shaft end face cannot be tapped and the accessories listed at right are not provided.

Unit [mm]

Size		024	044	074	154
Tightening collars: 1	ϕ 6.5 × ϕ 35 × 3.2t	–	○	○	○
Screw stocks: 1	M5 × 70	–	○		
	M6 × 100	–		○	○
Hexagonal nuts: 1	M5	–	○		
	M6	–		○	○

How to Place an Order

Base-mounted

0.2kW : BMS-024-NHBN-☐
Option symbols

0.4kW : BMS-044-NHB -☐
Option symbols

0.75kW : BMS-074-HPB -☐
Option symbols

1.5kW : BMS-154-HPB -☐
Option symbols

Flange-mounted

0.2kW : BMS-024-NHFN-☐
Option symbols

0.4kW : BMS-044-NHF -☐
Option symbols

0.75kW : BMS-074-HPF -☐
Option symbols

1.5kW : BMS-154-HPF -☐
Option symbols

BMM Models Electromagnetic-actuated Brake Motors

Specifications

Model	Motor			Brake							Rotating part moment of inertia J [kg·m^2]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T[J]	Operating time		Mass [kg]
	Frame No.	Output [kW] 4-poles	Torque T [N·m]	Coil (at 20℃)				Heat resistance class	Air gap					Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	
				Voltage [V]	Current [A]	Resistance [Ω]	Wattage [W]		Control value [mm]	Limit value [mm]						
BMM-024-NHBN	63	0.2	2.5	DC180	0.06	2956	11	B	0.10 ～ 0.20	0.30	0.9×10^{-3}	11	5.0×10^{7}	0.015	0.015	7
BMM-024-NHFN																8
BMM-044-NHB	71	0.4	5	DC180	0.07	2458	12.6	B	0.10 ～ 0.20	0.35	2.4×10^{-3}	26.2	7.0×10^{7}	0.030	0.030	9
BMM-044-NHF																10
BMM-074-HPB	80	0.75	10	DC180	0.089	2039	16	B	0.15 ～ 0.25	0.45	3.8×10^{-3}	32.7	17.0×10^{7}	0.040	0.040	14.5
BMM-074-HPF																16.5
BMM-154-HPB	90	1.5	20	DC180	0.123	1466	22.1	B	0.15 ～ 0.25	0.70	9.5×10^{-3}	45.8	25.0×10^{7}	0.060	0.060	22
BMM-154-HPF																25
BMM-224-HPB	100	2.2	30	DC180	0.167	1080	30	B	0.20 ～ 0.30	1.00	15.2×10^{-3}	58.9	50.0×10^{7}	0.070	0.070	32
BMM-224-HPF																37
BMM-374-HPB	112	3.7	50	DC180	0.17	1059	30.6	B	0.20 ～ 0.30	1.10	22.6×10^{-3}	73.6	75.0×10^{7}	0.070	0.080	42
BMM-374-HPF																47

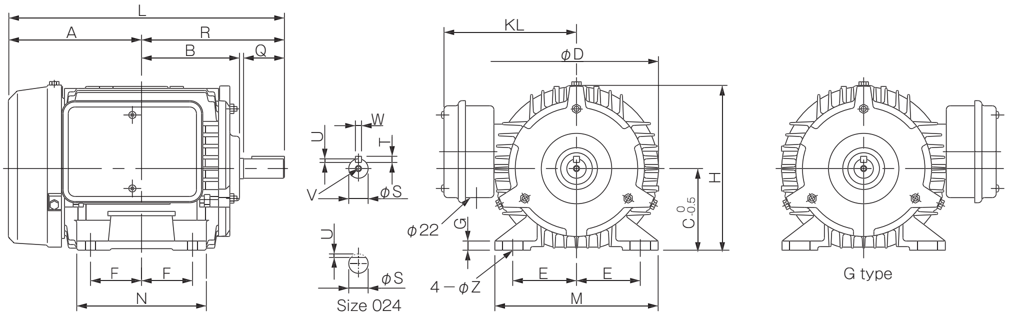
* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher). (made by Hitachi Industrial Equipment Systems)

* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.

* See P.377 for the allowable braking frequency of brake motors. The specific frequency varies with load conditions, so confirm it in your selection calculations.

Dimensions

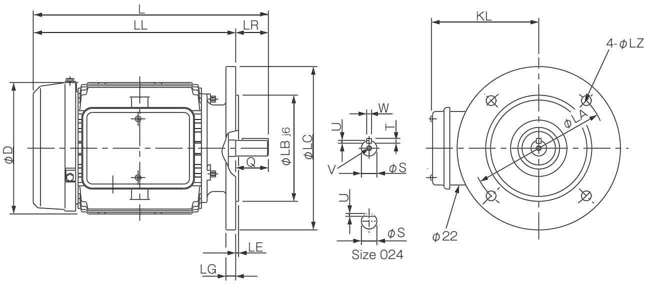
Base-mounted



Unit [mm]

Model	Dimensions of part																	
	L	R	A	B	D	KL	H	C	F	E	N	M	G	Z	S	W	U	T	Q	V
BMM-024-NHBN	215	103	112	80	130	115	128	63	40	50	100	130	3.2	7 × 21	11_{h6}	─	1	─	23	─
BMM-044-NHB	235.5	120	115.5	87	145	131	143.5	71	45	56	115	140	3.2	7 × 20	14_{j6}	5	3	5	30	M5 × 0.8, length: 18
BMM-074-HPB	280.5	140	140.5	97	163	138.5	161.5	80	50	62.5	125	160	3.2	10 × 25	19_{j6}	6	3.5	6	40	M6 × 1, length: 20
BMM-154-HPB	321	168.5	152.5	114.5	182	144	178	90	62.5	70	155	170	10	10	24_{j6}	8	4	7	50	M6 × 1, length: 20
BMM-224-HPB	368.5	193	175.5	129	198	151	197.5	100	70	80	175	195	12.5	12	28_{j6}	8	4	7	60	M6 × 1, length: 20
BMM-374-HPB	397	200	197	136	225	164	219.5	112	70	95	175	224	14	12	28_{j6}	8	4	7	60	M6 × 1, length: 20

Flange-mounted



Unit [mm]

Model	Dimensions of part															
	L	LR	LL	D	KL	LC	LB	LA	LE	LG	LZ	S	W	U	T	Q	V
BMM-024-NHFN	241	23	218	130	115	160	110	130	3.5	8	10	11_{h6}	─	1	─	23	─
BMM-044-NHF	256.5	30	226.5	145	124.5	160	110	130	3.5	10	10	14_{j6}	5	3	5	30	M5 × 0.8, length: 18
BMM-074-HPF	295	40	255	163	132	200	130	165	3.5	12	12	19_{j6}	6	3.5	6	40	M6 × 1, length: 20
BMM-154-HPF	341	50	291	176	144	200	130	165	3.5	12	12	24_{j6}	8	4	7	50	M6 × 1, length: 20
BMM-224-HPF	388.5	60	328.5	195	151	250	180	215	4.0	16	14.5	28_{j6}	8	4	7	60	M6 × 1, length: 20
BMM-374-HPF	422	60	362	215	164	250	180	215	4.0	16	14.5	28_{j6}	8	4	7	60	M6 × 1, length: 20

Optional

Made to Order

Products with Motor Terminal Box Mounted in Reverse

Option symbol: G

The location where the brake motor is installed may make it impossible to mount the motor's terminal box in the standard location in some cases. In such cases, the mounting dimensions of the G types can be considered.
Use the dimensions drawing to check the positions of the terminal boxes on G type motors.

Products with High Motor Output, 5.5 kW to 11 kW

We also support motors with high motor output (5.5 kW to 11 kW).
Consult Miki Pulley for details.

BMM-☐
Motor output/number of poles
554: 5.5 kW, 4-pole
754: 7.5 kW, 4-pole
1104: 11 kW, 4-pole

List of Accessories

Brake motors come with the components listed at right.
When mounting a V pulley or the like on a brake motor output shaft, the V pulley or the like can be mounted simply on the motor shaft by concurrently using a motor shaft end face tap and the accessories listed at right.
For size 024, the motor output shaft has a flat face, so the shaft end face cannot be tapped and the accessories listed at right are not provided.

Unit [mm]

Size		024	044	074	154	224	374
Tightening collars: 1	ϕ 6.5 × ϕ 35 × 3.2t	–	○	○	○	○	○
Screw stocks: 1	M5 × 70	–	○				
	M6 × 100	–		○	○	○	○
Hexagonal nuts: 1	M5	–	○				
	M6	–		○	○	○	○

How to Place an Order

Base-mounted

0.2kW : BMM-024-NHBN-☐
Option symbols

0.4kW : BMM-044-NHB -☐
Option symbols

0.75kW : BMM-074-HPB -☐
Option symbols

1.5kW : BMM-154-HPB -☐
Option symbols

2.2kW : BMM-224-HPB -☐
Option symbols

3.7kW : BMM-374-HPB -☐
Option symbols

Flange-mounted

0.2kW : BMM-024-NHFN-☐
Option symbols

0.4kW : BMM-044-NHF -☐
Option symbols

0.75kW : BMM-074-HPF -☐
Option symbols

1.5kW : BMM-154-HPF -☐
Option symbols

2.2kW : BMM-224-HPF -☐
Option symbols

3.7kW : BMM-374-HPF -☐
Option symbols

BMS/BMM Models

Selection

Study the following items, in order, to determine the final size and type.

• Operating condition settings ··············	Set the application, torque, number of operations, etc.
• Consideration of torque ·····················	Confirm the torque using Eqs. (1) and (2).
• Provisional size and type selection········	Provisionally select the size and type based on calculated torque values.
• Consideration of braking time ···········	Provisionally select the braking time based on calculated torque values.
• Consideration of amount of energy ·····	Confirm the energy amount using Eqs. (4) and (5).
• Consideration of number of braking operations ···	Confirm the number of braking operations using Eqs. (6) and (7).
• Determine size and type	

Consideration of Torque

$$T_M = \frac{9550 \cdot P}{n} \quad [\text{N•m}] \quad \cdots\cdots (1)$$

T_M: Rated torque of motor [N•m]
P: Motor output [kW]
n: Rated rotation speed of motor [min^{-1}]

$$T_B = K \cdot T_M \ [\text{N•m}] \quad \cdots\cdots (2)$$

T_B: Braking torque [N•m]
K: Safety factor (1.5 to 2.0)

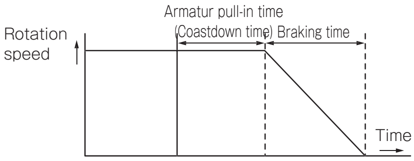
Consideration of Braking Time

The braking time can be found for brakes using the following equation.

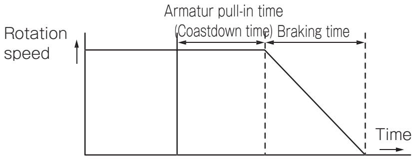
$$t_{ab} = \frac{J \cdot n}{9.55 \cdot (T \pm T_\ell)} \quad [\text{s}] \quad \cdots\cdots (3)$$

t_{ab}: Braking time [s]
J: Moment of inertia of brake shaft [kg•m^2]
n: Motor rotation speed [min^{-1}]
T: Rated torque of brake [N•m]
T_ℓ : Load torque [N•m]
(The sign of T_ℓ is positive when the load works in the direction that assists braking and negative when it works in the direction that opposes it.)

The time required from excitation of the brake coil to stopping of the load on BMM models is the braking time t_{ab} found with the preceding equation plus the armature pull-in time.



The time required from cutting off the power supply of a BMS model brake motor to stopping of the load is the braking time t_{ab} found with the above equation plus the armature release time.



When brakes are used for long periods of time, they wear, air gaps grow, and it becomes impossible to pull in the armature even when the coil is excited. If re-adjustment becomes necessary, adjust the air gap as described in the maintenance and inspection section of the operating manual.

Consideration of Amount of Energy

The braking energy rate can be found for brakes using the following equation.

$$P = \frac{J \cdot n^2}{182} \cdot \frac{T}{(T \pm T_\ell)} \cdot \frac{S}{60} \quad [\text{W}] \quad \cdots\cdots (4)$$

P: Braking energy rate [W]
S: Frequency of braking (braking operations/min)

Set a frequency that results in a value P obtained in the above equation that is no greater than the allowable braking energy rate $P_{ba\ell}$.

$$P \ll P_{ba\ell} \quad \cdots\cdots (5)$$

Consideration of Number of Braking Operations

Use the following equation to find the number of operations before readjustment of the air gap of the brake.

$$E_b = \frac{J \cdot n^2}{182} \cdot \frac{T}{(T \pm T_\ell)} \quad [\text{J}] \quad \cdots\cdots (6)$$

E_b: Braking energy of one braking operation [J]

$$L = \frac{E_T}{E_b} \quad [\text{braking operations}] \quad \cdots\cdots (7)$$

L: Number of operations before readjustment [braking operations]
E_T: Total braking energy [J]

Items Checked for Design Purposes

Precautions for Handling

What is the best way to ensure that the design allows brake motors used in machinery and equipment to perform and function adequately? We describe here approaches to design that we feel are useful in improving machinery reliability. Consult the catalog of the motor manufacturer for information on connecting motors to machinery using V pulleys or the like.

- Design in a reasonable space on the fan cover side to allow for cooling, maintenance and inspections.
- Operating temperature range: −10℃ to 40℃ . Contact Miki Pulley if you will use the product outside this range.
- If you are using this brake motor in a winch, lift, or the like, also use a brake of a different mechanism to prevent dangerous situations. Also, if you are using a standard shutoff circuit in an elevating winch or the like, there will be a θ load during the braking delay time and an electromotive force will occur in the motor part that will prevent the brake from engaging. For that reason, be sure to use a DC shutoff or separate shutoff circuit.
- If you are mounting a phase-advancing capacitor, consult Miki Pulley.
- Brake motors have consumable components such as linings, and thus have a finite service life. Please keep spares available. Also note that if the start frequency of the brake motor exceeds the allowed value, motor parts may burn or the brake lining may be subject to abnormal wear or damage. Check that the start frequency is staying within the allowed value. Also be aware of the capacitance of contacts for DC shutoff when you are inching at a frequency that exceeds the allowable start frequency.

Allowable start frequency of brake motor

Models	Motor output [kW]	Frequency [starts/h]		Moment of inertia of load J [kg·m²]
		40%ED	60%ED	
BMS	0.2	500	400	0.00125
	0.4	900	845	0.00128
	0.75	460	430	0.0028
	1.5	370	290	0.0045
BMM	0.2	450	360	0.00125
	0.4	900	845	0.00128
	0.75	460	430	0.0028
	1.5	370	290	0.0045
	2.2	180	145	0.010
	3.7	180	145	0.015

* These values are for 4 poles and a frequency of 50 Hz using the moment of inertia J of the load from the above table as the condition. For 60 Hz, use frequencies of about 70% of the above values.
* Frequency is a total value for the motor part and brake together. Their values as stand-alones are different.
* %ED is the percentage duty cycle during repeated operation.
* The table's example of moment of inertia J of the load is virtually the same as the moment of inertia J of the motor part.
* The approximate temperature of the outer surface of the motor is 80° C to 90° C (for an ambient temperature of 40° C).

- If using an inverter or reduced-voltage starting, connect the brake or brake power supply to the power supply side of the inverter or reduced-voltage starter.
- If the wiring for the brake circuit is in the same conduit as the power lines, be sure to shield it.
- When inserting a capacitor for improving the power factor into the brake motor circuit, be sure to use a separate shutoff circuit.
- Grounding terminals are provided in or on the side of the terminal box or at the bottom of the frame. Be sure to do the grounding work. Mobile or movable machinery is covered by labor safety regulations as well. Be sure to ground it with large-gauge grounding wires to prevent accidents from shocks.
- Keep the voltage imbalance rate to 1% or less. Also keep the maximum current value for each phase to 105% or less of the nameplate current value when a voltage imbalance occurs.
- Always mount the cover on the terminal box after connections are made.
- Brake torque may vary somewhat. Break-in operation (40 to 60 brakings) is particularly advisable at initial use.
- If power goes out, be sure to turn the power switch off. Accidents can occur if the electricity comes back on unexpectedly.
- Before starting a BMS model, always check that the release lever is in the non-operating position before starting machinery operation.

Wiring

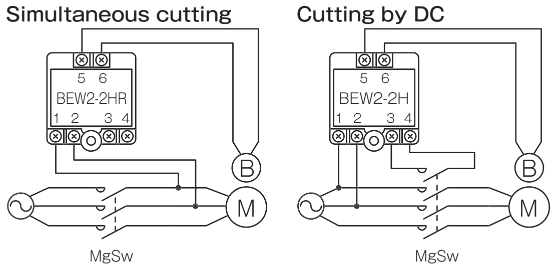
■ BMS

A power supply with built-in relays (BEW2-2HR) is incorporated into BMS models, so BMS models generally have a responsiveness close to that of separate DC shutoff, and are adequate for use. By concurrently using an inverter or the like, the motor can be fitted with a power supply that shuts off DC separately (BEW2-2H) when even faster response is needed. This is supported as an option. Please specify it in advance.

BEW2-2HR:	Brake power supply for building into relays for BMS (built into terminal box)
MgSw:	Electromagnetic switch
M:	Motor
B:	Brake

The power supply, motor terminal block, and brake are connected in advance, so the unit can be used by wiring only the U, V, and W leads of the motor.

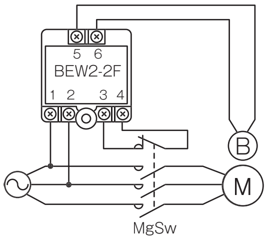
BEW2-2H: Separate shutoff power supply for BMS
(Specify in advance when ordering a brake motor.)



■ BMM

BEW2-2F:	Brake power supply for BMM (built into terminal box)
MgSw:	Electromagnetic switch
M:	Motor
B:	Brake

(BEW2-2F is connected in advance.)



Precautions for Use

Inspect the following items periodically.

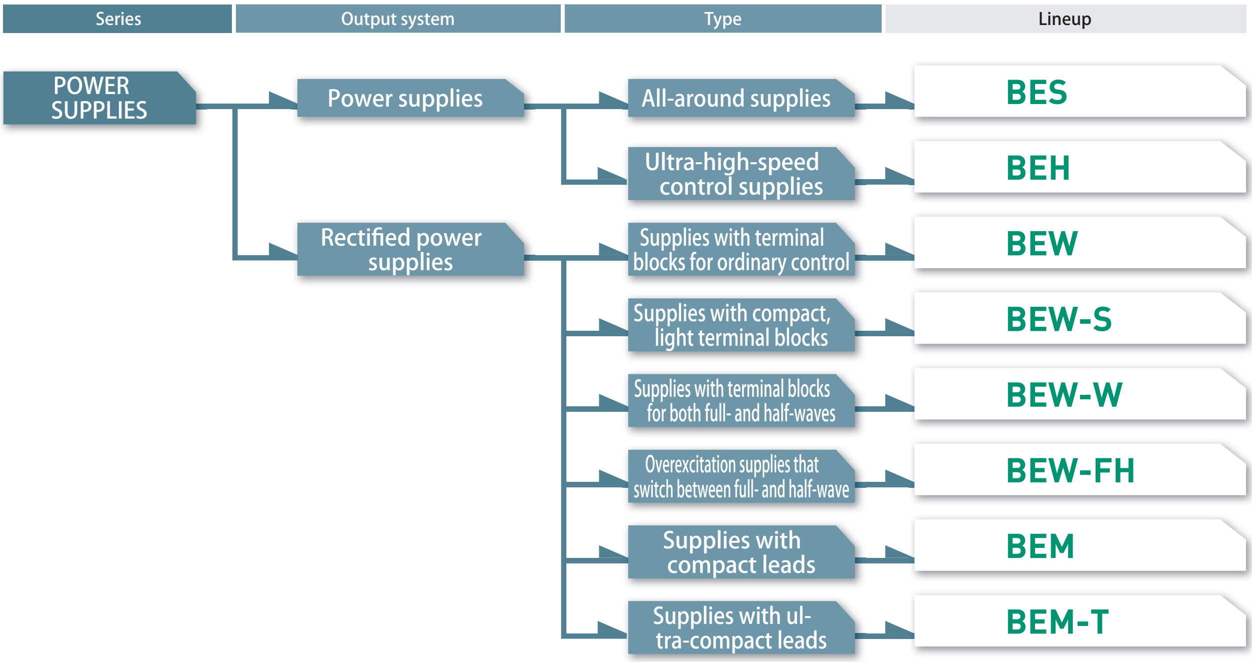
- Is the device operating properly?
- Has water or oil penetrated the brake part?
- Has tightening of the mounting screws of all parts been completed?
- During periodic inspections, remove the motor fan cover and use compressed air to blow out wear debris created by friction to eliminate it or pull-in it up with a dust collector.
- Check whether the air gap is within its service life limit. If it is at the limit value, adjust it to the prescribed air gap stated in the operating manual.
- If the limit air gap has been exceeded, BMS models are particularly prone to the brake becoming unable to release due to malfunctioning armature pull-in, which can lead to problems such as motors burning.

POWER SUPPLIES

Power Supplies to Get the Best Performance from Electromagnetic Clutches and Brakes

Compatible with AC 100, 200, and 400 V input power supplies. Outputs DC 24, 45, 90, and 180 V specifications for electromagnetic clutches and brakes. Broadly divided into power supplies for electromagnetic-actuated devices, which primarily require high-speed and ultra-high-speed control, and rectified power supplies, which are used by spring-actuated brakes and the like. A broad selection of power supplies are available.

Available Models



Series	Output system	Type	Lineup
POWER SUPPLIES	Power supplies	All-around supplies	BES
		Ultra-high-speed control supplies	BEH
	Rectified power supplies	Supplies with terminal blocks for ordinary control	BEW
		Supplies with compact, light terminal blocks	BEW-S
		Supplies with terminal blocks for both full- and half-waves	BEW-W
		Overexcitation supplies that switch between full- and half-wave	BEW-FH
		Supplies with compact leads	BEM
		Supplies with ul-tra-compact leads	BEM-T

Model Selection

Model/Type	Applicable clutches and brakes			Input voltage			Output voltage				Function		
	Electromagnetic-actuated	Tooth	Spring-actuated	100V	200V	400V	24V	45V	90V	180V	Overexcitation	Reverse excitation	Weak excitation
BES	◎	◎	◎	◎	◎		◎	◎	◎		◎		
BEH	◎	◎		◎	◎		◎				◎	◎	
BEW			◎	◎	◎	◎		◎	◎	◎			
BEW-S			◎	◎	◎	◎		◎	◎	◎			
BEW-W			◎	◎	◎	◎		◎	◎	◎			
BEW-FH			◎	◎	◎	◎		◎	◎	◎	◎		◎
BEM			◎	◎	◎	◎		◎	◎	◎			
BEM-T			◎	◎	◎	◎		◎	◎	◎			

Product Lineup

BES

For ordinary high-speed control

RoHS-compliant

All-around types suitable for the full range of electromagnetic clutches and brakes

Built-in overexcitation function

Can operate at high frequency and high precision.

Zero standby power

When used with one of our spring-actuated brakes, power consumption can be reduced by over 70%.

Light and compact

All terminals are contactless.

Compatible with international standards

UL listed. Products compatible with EC directives (CE markings) are available as options.

Applicable clutches and brakes

Electromagnetic-actuated clutches and brakes
Tooth clutches
Spring-actuated brake

Input voltage

AC100V/200V

Output voltage

DC24V/45V/90V

BEH

For ultra-high-speed control

RoHS-compliant

Top-of-the-line ultra-high-speed control, high-precision types with built-in overexcitation/reverse excitation functions

Quiet design

There is no excitation noise while operating.

Combination control is easy

Operations that frequently switch clutches and brakes, such as inching, can be performed using only a single input signal.

An array of operating modes

Compatible with a diverse range of applications.

Auto-tuning function

Easy to set for the optimum operating conditions. Causes of problems can also be easily identified using the alarm displays.

Applicable clutches and brakes

Electromagnetic-actuated clutches and brakes
Tooth clutches

Input voltage

AC100V/200V

Output voltage

DC24V

BEW

For ordinary control

RoHS-compliant

Basic power supply device model for electromagnetic clutch and brake control

Diverse array of specifications

Power supplies are available with a variety of specifications, including half-wave rectified and full-wave rectified.

Terminal block type

These are of the terminal block type, which allows easy connection, with a DC switching terminal.

Applicable clutches and brakes

Spring-actuated brake
Electromagnetic-actuated clutches and brakes

Input voltage

AC100V/200V/400V

Output voltage

DC45V/90V/180V

BEW-S

Compact, light

RoHS-compliant

Power supplies for ordinary control of spring-actuated brakes

Half-wave rectified

Compact, light models with selected functions.

Terminal block type

These are types with terminal blocks that make connection easy. They are simple power supplies that are set on only the input side and output side.

Applicable clutches and brakes

Spring-actuated brake

Input voltage

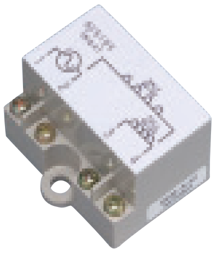
AC100V/200V/400V

Output voltage

DC45V/90V/180V

BEW-W

For both full- and half-wave rectification



RoHS-compliant

Spring-actuated brakes with different specifications can be handled by a single unit

For both full- and half-wave rectification

Half-wave and full-wave rectified output can be handled by changing the connection method.

Compact, high wattage

Take a wide range of electrical inputs, from low voltage to high.

Terminal block type

These are types with terminal blocks that make connection easy. They are simple power supplies that are set on only the input side and output side.

Applicable clutches and brakes

Spring-actuated brake

Input voltage

AC100V/200V/400V

Output voltage

DC45V/90V/180V

BEW-FH

Compact overexcitation power supplies

RoHS-compliant

Can be set for the outcome you desire: higher operating speed, longer service life, and more

Used as overexcitation supplies

These provide benefits such as super-long (roughly double) service lives and shorter (roughly halved) armature pull-in times for electromagnetic clutches and brakes.

Used as weak excitation supplies

These provide benefits such as lower power consumption (roughly one quarter), suppressed heat generation (roughly one quarter) in the stator (electromagnetic coil), and shorter armature release times.

Terminal block type

These are of the terminal block type, which allows easy connection, with a DC switching terminal.

Applicable clutches and brakes

Spring-actuated brake

Input voltage

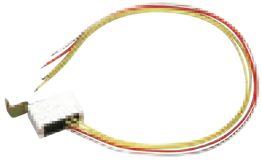
AC100V/200V/400V

Output voltage

DC45V/90V/180V

BEM

Compact, light



RoHS-compliant

Power supplies for ordinary control of spring-actuated brakes

Lead type

These are lead input/output types that are suited to relay connections.

Usable in adverse environments

Since the entire case is molded of resin, they can be used in atmospheres such as dusty locations.

Applicable clutches and brakes

Spring-actuated brake

Input voltage

AC100V/200V/400V

Output voltage

DC45V/90V/180V

BEM-T

Ultra-compact, light

RoHS-compliant

Power supplies for ordinary control of spring-actuated brakes

Easy connection

Uses tab terminals on the output side to achieve reductions in connection space and man-hours.

Mounting freedom

These are compact, slim, and can be installed anywhere. The mountings are also movable, so the input/output direction can be set freely.

Usable in adverse environments

Since the entire case is molded of resin, they can be used in atmospheres such as dusty locations.

Applicable clutches and brakes

Spring-actuated brake

Input voltage

AC100V/200V/400V

Output voltage

DC45V/90V/180V

BES Models For Ordinary High-speed Control

Specifications

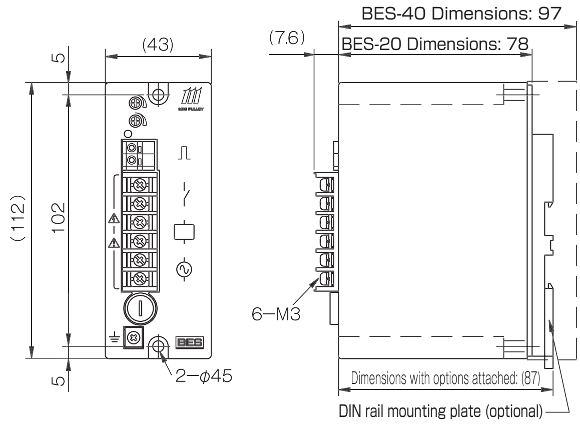
Model	BES-20-□-1	BES-40-□-1	BES-20-□	BES-40-□
Input voltage	AC100V ± 10% 50/60Hz		AC200V ± 10% 50/60Hz	
Output current	2.0A	4.0A	2.0A	4.0A
Voltage control system	PWM control			
Constant excitation voltage	Adjusted for each model and size at the time of shipment			
Overexcitation voltage	DC 90 V Full-wave (with AC 100 V input)		DC 180 V Full-wave (with AC 200 V input)	
Overexcitation time	Adjusted for each model and size at the time of shipment			
Protective functions	Input side Quick-acting fuse (5A)			
Insulating resistance	DC 500 V With Megger 100 M Ω (between terminal and main body)			
Dielectric strength voltage	AC 1000 V 50 Hz 1 min. (between terminal and main body)			
Usage environment	-10 to +50℃ /10 to 90%RH (with no condensation)			
Mass	0.3kg	0.7kg	0.3kg	0.7kg

* The voltage that is output is not insulated from the power supply, so shocks can result if touched.

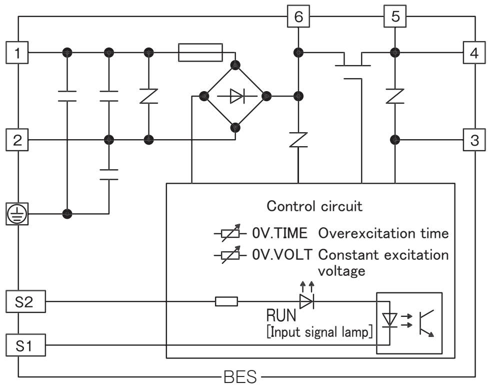
Terminals and Functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake
5-6	Control terminal 1	Output is controlled by opening and closing between terminals using a relay or the like.
	Ground terminal	External ground terminal (third class ground or more)
S1-S2	Control terminal 2	Output is controlled by turning the DC 24 V on and off (30 mA, smoothing power supply)

Dimensions



Structure



How to Place an Order

BES-20-10-1 DIN

Output current 20: 2 A
40: 4 A

Refer to the power supply size compatibility table

Input voltage 1: 100 V AC
Blank: 200 V AC

Mounting method
DIN: Mounting by DIN mounting rail
Blank: Direct mounting
*The DIN mounting rail mounting option can only be set for BES-20.

Options (Sets that meet EMC directives)

Equipment can conform to EC directives (for the CE marking) if you also order, using the following model number, a noise filter (one) and ferrite cores (two) as a set to meet EMC directives.

BES-20-EMC

Table of Power Supply/Size Correspondence

MIKI PULLEY electromagnetic-actuated clutch/brake size		02	025	03	04	05	06	08	10	12	16	20	25
Nominal power supply output current		20											40
Power supply size	Excitation voltage For 24 V	05					10			16		20	25

MIKI PULLEY electromagnetic tooth clutch sizes		12	13	15	21	23	25	31	32
Nominal power supply output current		20						40	
Power supply size	Excitation voltage For 24 V	51			52			53	

MIKI PULLEY spring-actuated brake size		01	02	03	04	05	06	08	10	12	14	16	18	20	25
Nominal power supply output current		20													
Power supply size	Excitation voltage 45/90 V	61								62			63		
	Excitation voltage For 24 V	71								72			73		

* The constant excitation voltage for the 45/90 V excitation voltages of spring-actuated brakes is the DC 45 V specification for an input of AC 100 V and the DC 90 V specification for an input of AC 200 V.

Characteristics

Operating Response

All circuits have been made contactless, and response from signal input to output to the electromagnetic-actuated clutch or brake is fast and stable.

Energy Saving

Standby power is "zero." Absolutely no electricity is wastefully consumed.

By combining this power supply with a MIKI PULLEY spring-actuated brake, the electricity consumption and heat generation of the spring-actuated brake is reduced by more than 70%, saving energy.

Noise During Operation

BES models use a quiet design, but electromagnetic clutches and brakes may produce excitation noise when operating under some mounting conditions. This noise is not abnormal and is not cause for concern.

Two Types of Control Systems

You can operate under either PLC control (which uses voltage control via programmable controllers or the like) or contactor control (which controls using relays and the like).

In the case of contactor control, however, a power controller for controlling the power supply line must be used.

Supply Voltage Fluctuations and Output Voltage

BES model power supplies are designed to operate reliably even when supply voltage fluctuates. Characteristically, however, their output voltage will rise or fall along with rises and falls of supply voltage. To fulfill electromagnetic clutch/brake performance, supply voltage fluctuations should be kept within a range of ±10%.

Precautions for Use

Circuit Protector

BES models incorporate circuit protectors, so there is no need to connect circuit protectors to the output side (between 3 and 4). Also, since voltage is controlled using PWM, the actual voltage output is the same level as the input voltage. This means that connecting the varistor that comes with 24 V-specification clutches and brakes or the like may result in explosion of the varistor or damage to the power supply. Never connect such devices.

Protective Functions

BES models contain fuses on the input side. When a fuse engages, the likely cause is a malfunction on the output side.

- Short on output side
- Ground fault on output side
- Malfunction on output side (electromagnetic-actuated clutch/brake)

Thoroughly verify that there are no malfunctions on the output side before resuming operation.

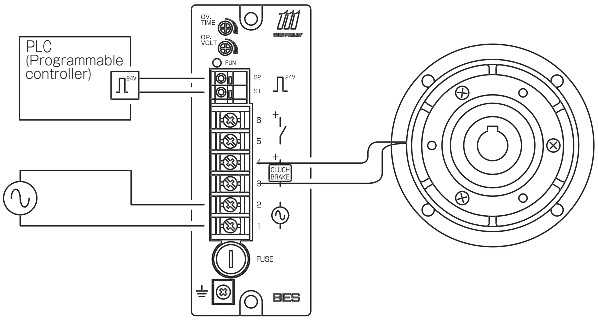
How to Check Output Voltage Values

If you are checking the output voltage with a voltage meter, tester or the like, check the value with a load such as an electromagnetic clutch or brake connected to the output side.

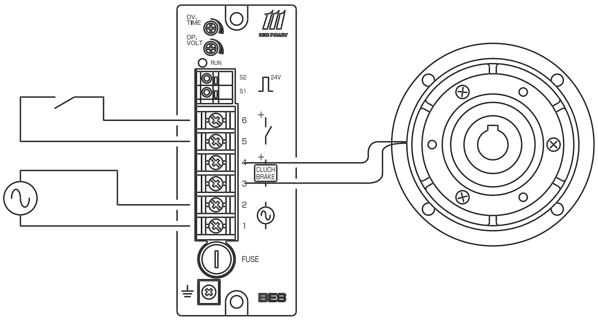
If nothing is connected, it shows a value close to the supply voltage.

Wiring Methods and Timing Charts

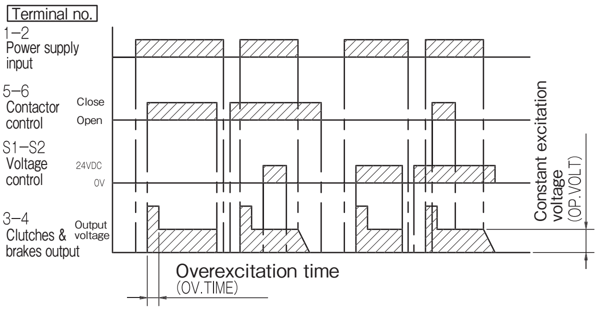
Wiring 1 (PLC Control)



Wiring 2 (Contactor Control)



Time Chart



BEH Models For Ultra-high-speed Control

Specifications

Model		BEH-10G	BEH-20G	BEH-20G-1
Input voltage		AC200V ± 10%	AC200V ± 10%	AC100V ± 10%
		Single phase, 50/60 Hz		
Output voltage	Overexcitation voltage	Initial value 100 V, 0 to 250 V variable		
	Constant excitation voltage	Initial value 24 V, 0 to 250 V variable		
	Reverse excitation voltage	Initial value 100 V, 0 to 250 V variable		
	Voltage control system	PWM control		
Output current		2A	4A	4A
Applicable clutch/ brake size		02 ～ 16	02 ～ 32	
		MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 24 V		
Protective functions		Undervoltage protection, overvoltage protection, overcurrent protection/detection, break detection, element overheating protection, input-side fuse (20 A)		
Usage environment		-10 - +50℃ / 10 - 90%RH		
Mass		0.85kg	0.9kg	0.9kg

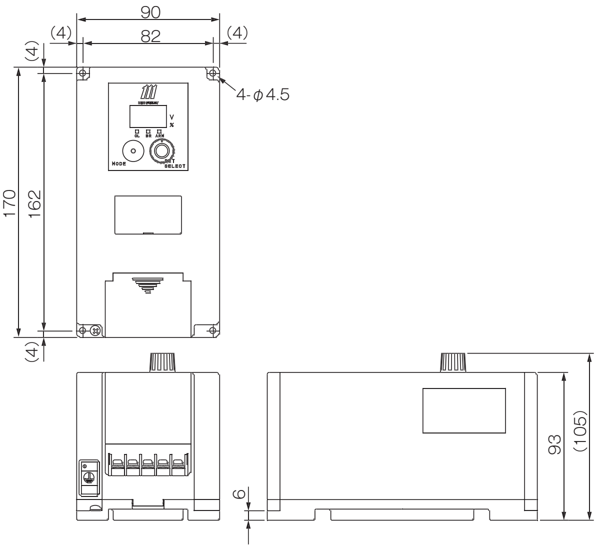
Operating Settings

Operating settings SW (SW3) Switch No.		ON (up)	OFF (down)	Settings when shipped
1	Setup/operating mode	Setup mode	Operation mode	OFF
2	Stand-alone/ interlocked mode	Stand-alone mode	Interlocked mode	OFF
3	Break/overcurrent detection	Enabled	Disabled	OFF
4	Current/voltage control	Current control	Voltage control	OFF
5	Control AUX	Enabled	Disabled	OFF
6	Jog operation	Enabled	Disabled	OFF
7	Slope operation	Enabled	Disabled	OFF
8	One-shot operation	Enabled	Disabled	OFF

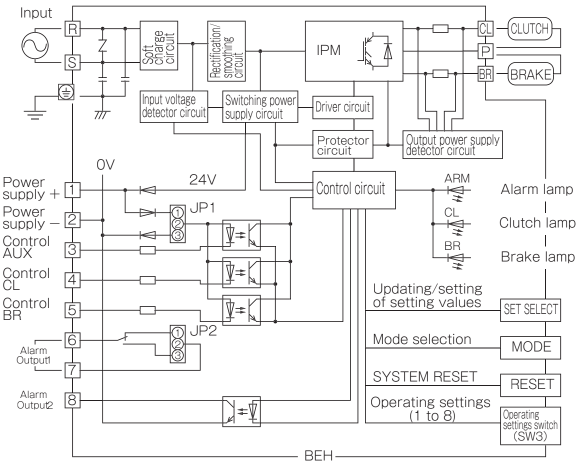
Terminals and Functions

Terminal symbol	Terminal name	Function description
R-S	Power supply input terminal	Connector for a commercial power supply
CL-P	Clutch output terminal	Connector for a clutch
BR-P	Brake output terminal	Connector for a brake
⏚	Ground	External ground terminal (third class ground or more)
1	Power supply terminal +	Positive terminal of control power supply (shared with the internal supply's +24 V)
2	Power supply terminal -	Negative terminal of control power supply (shared with the internal supply's 0 V)
3	Control AUX	When operating switch 5 (AUX operation) is on, executes the operation of the conditions set in the table.
4	Control clutch	Turns output between P and CL on and off.
5	Control brake	Turns output between P and BR on and off.
6・7	Alarm output 1	A relay that operates during an alarm stop (relay output)
8	Alarm output 2	Output operates during an alarm stop (transistor output)

Dimensions



Structure



Characteristics

Operating Response

The circuit construction is completely contactless, and response from signal input to output to the electromagnetic-actuated clutch or brake is fast and stable. The operating speed of the electromagnetic clutch or brake is also increased to the limit speed by the overexcitation and reverse excitation functions.
This is the top-of-the-line model for electromagnetic clutch/brake power supplies. It achieves ultra-high-speed control and high precision.

Noise During Operation

The BEH models are quiet power supplies.
Electromagnetic clutches and brakes normally produce howling sounds during operation. The quiet design of BEH models eliminates such sounds.

Output Control System

You can select either Stand-alone Mode, which controls stand-alone electromagnetic clutches and brakes independently, or Interlocked Mode, which is suited to combination control of electromagnetic clutches and brakes.
There is also a diverse array of other operating modes, such as current control mode and jog mode. These are compatible with a diversity of applications.

Supply Voltage Fluctuations and Output Voltage

BEH models control output voltage to be constant even with a certain amount of supply voltage fluctuation. This ensures stable output even in locations with a bad power supply environment. Variations in electromagnetic clutch/brake response disappear.
However, overly large voltage fluctuations will be sensed as abnormal voltages and set off an alarm. To ensure proper operation, keep supply voltage fluctuation to within a range of ± 10%.

Precautions for Use

Circuit Protector

BEH models incorporate circuit protectors, so there is no need to connect circuit protectors to the output side (between CL, P and BR). When a circuit protector is included, the alarm goes off and operation stops. Also, since voltage is controlled using PWM, the actual voltage output is the same level as the input voltage. This means that connecting the varistor that comes with 24 V-specification clutches and brakes or the like may result in explosion of the varistor or damage to the power supply. Never connect such devices.

Power Supply Protective Functions

These power supplies are equipped with a variety of protective functions.
These functions also alert the user to the cause of the alarm when the various alarms engage. Thoroughly verify that the cause of the alarm has been cleared and that there are no abnormalities before resuming operation.

How to Check Output Voltage Values

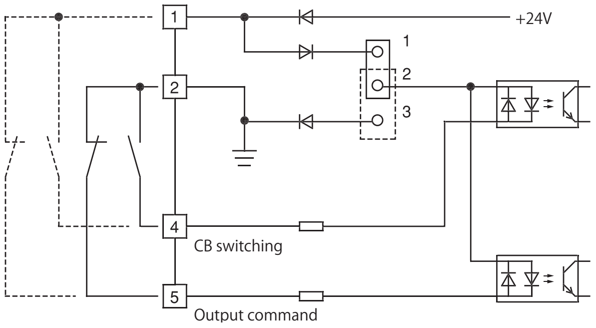
If you are checking the output voltage with a voltage meter, tester or the like, check the value with a load such as an electromagnetic clutch or brake connected to the output side.
If nothing is connected, the protective functions of break detection engage, and a value around the DC 280 V charged in the capacitor is shown, due to the characteristics of this power supply.

Applicable Ranges and Special Adjustments

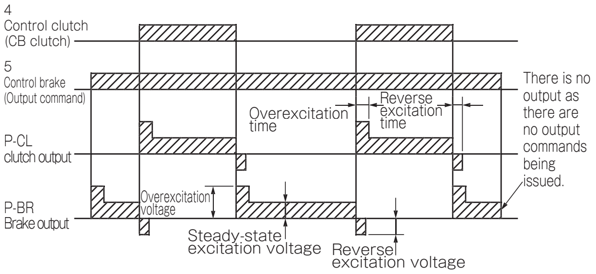
These power supplies can be used as supplies for all electromagnetic coils, not just electromagnetic clutches and brakes. The conducting conditions can be altered freely by changing internal settings. Feel free to consult Miki Pulley regarding settings, operating methods, and the like.

Wiring Methods and Timing Charts

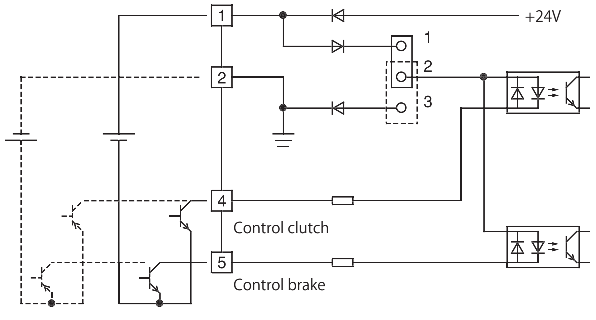
Interlocked Mode (Operating Settings SW-2 Off)



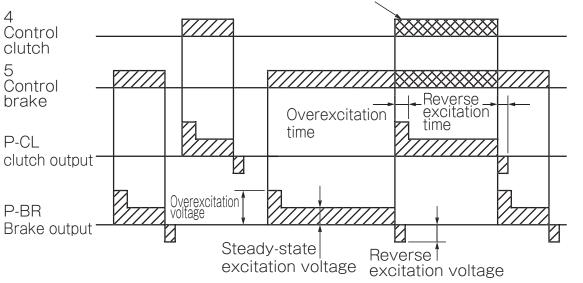
Terminal no. Toggles between the clutch and brake using a single input signal.



Stand-alone Mode (Operating Settings SW-2 On)



Terminal no. The corresponding clutch/brake operates using the signals received by the input terminals.
(Clutches and brakes cannot release output at the same time.)
The priority to determine the order of importance for signals received simultaneously can be set as desired.
*The factory default setting is clutch priority.



How to Place an Order

BEH-20G-1

Output capacity
10: 50 W
20: 100

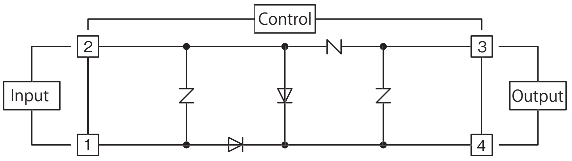
Input voltage specifications
Blank: 200 V AC
1: 100 V AC

BEW Models Supplies with Terminal Blocks for Ordinary Control

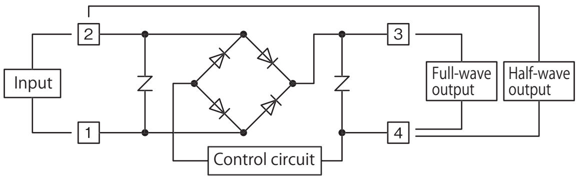
Specifications

Model			BEW-2G		BEW-4G			BEW-1R		BEW-2R		BEW-4R	
Input voltage	AC100V	± 10% 50/60Hz	●		●			●					
	AC200V			●		●				●			
	AC400V						●					●	
	Input voltage range		AC 280 V max.		AC 480 V max.			AC90 ～ 140V		AC180 ～ 280V		AC360 ～ 480V	
Rectification method			Half-wave rectification					For both half- and full-wave rectification					
								Half-wave	Full-wave	Half-wave	Full-wave	Half-wave	Full-wave
	Output voltage		DC45V	DC90V	DC45V	DC90V	DC180V	DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.0A (DC0.7A)		DC1.0A (DC0.7A)			DC2.0A (DC1.5A)		DC1.0A (DC0.7A)		DC0.7A (DC0.5A)	
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)	126W (90W)	252W (180W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)	DC45V (AC100V)	DC90V (AC100V)	DC90V (AC200V)	DC180V (AC200V)	DC180V (AC400V)	DC360V (AC400V)
	● Applicable △: Applicable depending on clutch/brake model	01	●	●	●	●	●	●	●	●	●	●	
		02	●	●	●	●	●	●	●	●	●	●	
		03	●	●	●	●	●	●	●	●	●	●	
		04	●	●	●	●	●	●	●	●	●	●	
		05	●	●	●	●	●	●	●	●	●	●	
		06	●	●	●	●	●	●	●	●	●	●	
		08	●	●	●	●	●	●	●	●	●	●	
		10	●	●	●	●	●	●	●	●	●	●	
		12		●		●	●		●	●	●	●	
		14		●		●	●		●	●	●	●	
		16		●		●	●		●	●	●	●	
		18		△		△	●		●	△	●	●	
		20		△		△	●		●	△	●	●	
		25		△		△	●		●	△	●	●	
Applied clutches/ brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V DC45/90/180V		Spring-actuated brake					All					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger										
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.		2000 V AC, 50 Hz, 1 min.			1500 V AC, 50 Hz, 1 min.				2000 V AC, 50 Hz, 1 min.	
Usage environment	With no condensation		-20 - +60℃										
Mass	Per product		0.04kg										

Structure

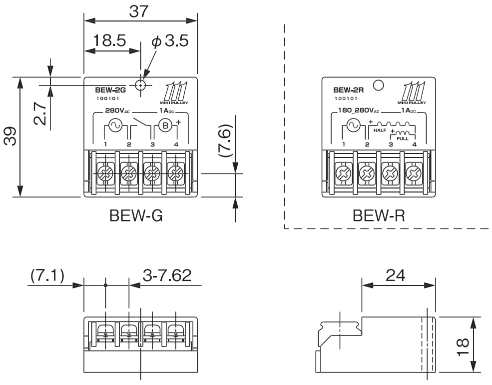


BEW-2G/4G



BEW-1R/2R/4R

Dimensions



Terminals and Functions

Model	Terminal symbol	Terminal name	Function description
BEW-G	1-2	Power supply input terminal	Connector for a commercial power supply
	2-3	Control terminal	Output is controlled by opening and closing between terminals with a relay or other contact
	3-4	Output terminal	Connector for an electromagnetic clutch or brake
BEW-R	1-2	Power supply input terminal	Connector for a commercial power supply
	2-4	Output terminal (half-wave)	Connector for an electromagnetic clutch or brake (when half-wave rectified)
	3-4	Output terminal (full-wave)	Connector for an electromagnetic clutch or brake (when full-wave rectified)

Characteristics

Output System

Two systems are available, half-wave rectified and full-wave rectified. Half-wave rectified takes a commercial power supply as the input and generates a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.

When the above are to be avoided, consider changing to a full-wave rectified supply, smoothing supply, or a DC 24 V specification.

Full-wave rectified power supply devices are known for having smaller voltage pulses than half-wave rectified supplies and tending to have little variation in electromagnetic clutch and brake operating response. They can thus be used not just for spring-actuated brakes but also for electromagnetic-actuated clutches and brakes.

Note that when the rated voltage of the electromagnetic coil does not match the voltage output from the power supply device, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Circuit Protector

These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

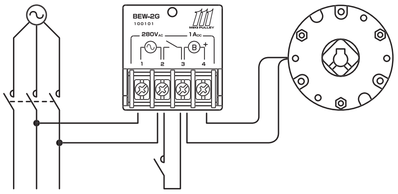
Primary and Secondary Control Methods

Primary control, which uses on/off of the input voltage to control electromagnetic clutches/brakes (shorting terminals 3-4), saves wiring, but makes the armature release time extremely long, so the braking time of the brake becomes long. (No surge voltage is generated.)

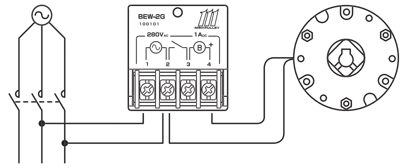
With secondary control (which controls terminals 3-4 with a relay or other contact), armature release time is shorter, as is the braking time of the brake, but there is more wiring and some surge voltages occur. Select primary or secondary control based on the characteristics you desire.

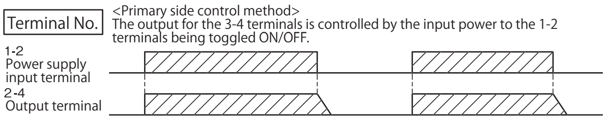
Wiring Methods and Timing Charts

BEW-G Secondary Control (Basic Wiring)



BEW-G Primary Control (Wire Saving)

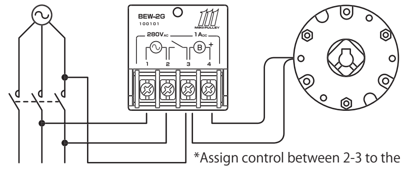




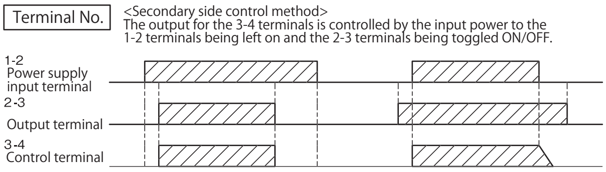
<Primary side control method>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

*Check the above before use as even though the back voltage from the coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increse.

BEW-G Secondary Control (Wire Saving)

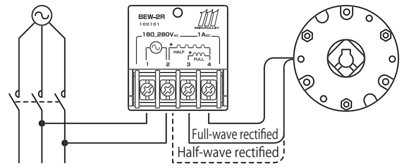


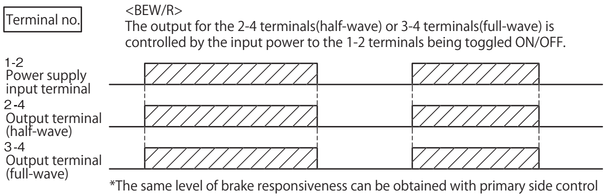
*Assign control between 2-3 to the same phase.



<Secondary side control method>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being left on and the 2-3 terminals being toggled ON/OFF.

BEW-R Primary Control





<BEW/R>
The output for the 2-4 terminals(half-wave) or 3-4 terminals(full-wave) is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

*The same level of brake responsiveness can be obtained with primary side control as with secondary side control.

How to Place an Order

BEW-2G

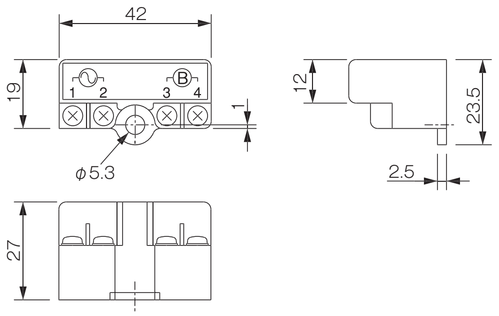
G	Specifications	G: Standard R: Relay included
2	Input voltage specifications	Rated input 1: 100 V AC Rated input 2: 200 V AC Rated input 4: 400 V AC

BEW-S Types Compact, Light Supplies with Terminal Blocks

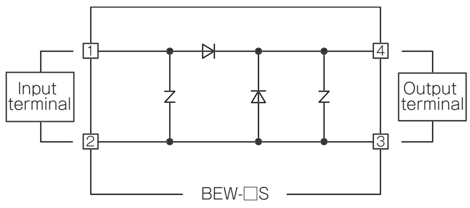
Specifications

Model			BEW-2S		BEW-4S		
Input voltage	AC100V	± 10% 50/60Hz	●		●		
	AC200V			●		●	
	AC400V						●
	Maximum input voltage		AC250V		AC510V		
Rectification method			Half-wave rectification				
	Output voltage		DC45V	DC90V	DC45V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in ( ) are for an ambient temperature of 60℃		DC1.0A (DC0.6A)				
Output Wattage	When the ambient temperature is 20℃ Values in ( ) are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)
	●: Applicable △: Applicable depending on clutch/ brake model	01	●	●	●	●	●
		02	●	●	●	●	●
		03	●	●	●	●	●
		04	●	●	●	●	●
		05	●	●	●	●	●
		06	●	●	●	●	●
		08	●	●	●	●	●
		10	●	●	●	●	●
		12		●		●	●
		14		●		●	●
		16		●		●	●
		18		△		△	●
		20		△		△	△
		25		△		△	△
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake				
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger				
Dielectric strength voltage			1000 V AC, 50 Hz, 1 min.		2000 V AC, 50 Hz, 1 min.		
Usage environment	With no condensation		-20 ～ +60℃				
Mass	Per product		0.021kg				

Dimensions



Structure



Terminals and functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake

Characteristics

Output System

BEW-2S/4S types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
When the above are to be avoided, consider changing to a full-wave rectified supply (BEW-R types), smoothing supply, or a DC 24 V specification.

How to Calculate Output Voltage
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectification**
(Ex.)
BEW-2S: AC100V × 0.45 = DC45V
BEW-4S: AC400V × 0.45 = DC180V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Circuit Protector

These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

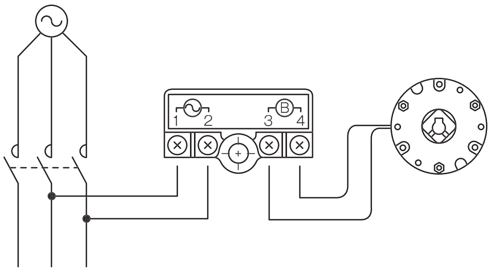
Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on small spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

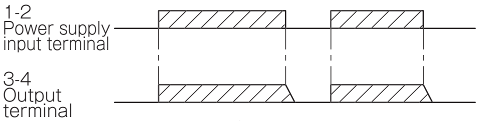
When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

Wiring Methods and Timing Charts

Primary Control

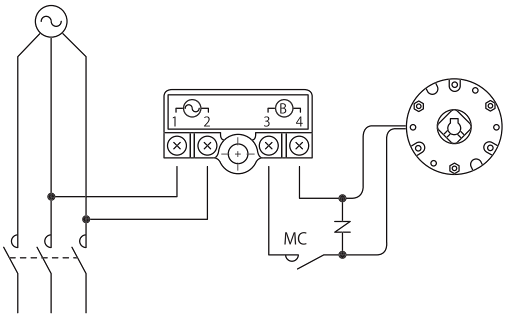


Terminal no. <<Primary side control method>>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

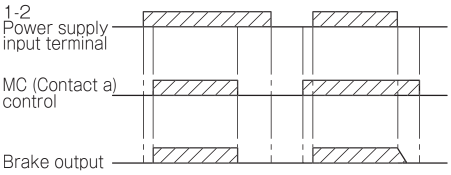


*Check the above before use as even though the surge voltage from the electromagnetic coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increse.

Secondary Control



Terminal no. <<Secondary side control method>>
The brake output is controlled by the input power being input to the 1-2 terminals and the relay being toggled ON/OFF.



How to Place an Order

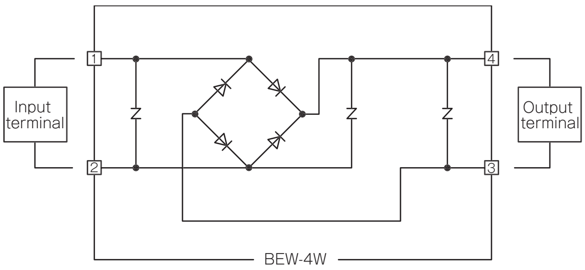
BEW-2S
Input voltage specifications
2: Rated input voltage of 200 V AC
4: Rated input voltage of 400 V AC

BEW-W Types Supplies with Terminal Blocks for Both Full- and Half-waves

Specifications

Model			BEW-4W					
Input voltage	AC100V	± 10% 50/60Hz	●					
	AC200V				●			
	AC400V						●	
	Maximum input voltage		AC510V					
Rectification method			For both half- and full-wave rectification					
			Half-wave	Full-wave	Half-wave	Full-wave	Half-wave	Full-wave
	Output voltage		DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC3.0A (DC2.5A)					
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		135W (112W)	270W (225W)	270W (225W)	540W (540W)	540W (540W)	1080W (900W)
Size Settings	Voltage specification Numbers in parentheses are input voltages		DC45V (AC 100 V half-wave)	DC90V (AC 100 V full-wave)	DC90V (AC 100 V full-wave)	DC180V (AC 400 V full-wave)	DC180V (AC 400 V half-wave)	DC360V (AC 400 V full-wave)
	● : Applicable △ : Applicable depending on model of clutch or brake	01	●	●	●	●	●	
		02	●	●	●	●	●	
		03	●	●	●	●	●	
		04	●	●	●	●	●	
		05	●	●	●	●	●	
		06	●	●	●	●	●	
		08	●	●	●	●	●	
		10	△	●	●	●	●	
		12	△	●	●	●	●	
		14	△	●	●	●	●	
		16	△	●	●	●	●	
		18	△	●	●	●	●	
		20	△	●	●	●	●	
		25	△	●	●	●	●	
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger					
Dielectric strength voltage			2200 V AC, 50 Hz, 1 min.					
Usage environment	With no condensation		-20 ～ +60℃ / 10 ～ 90%RH					
Mass	Per product		0.045kg					

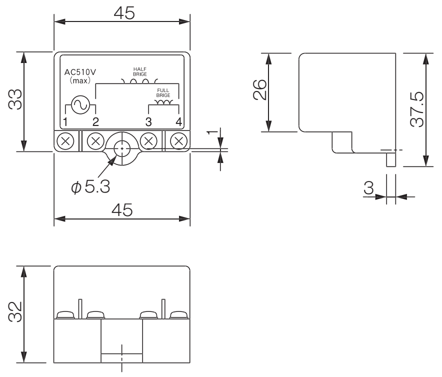
Structure



Terminals and Functions

Terminal symbol	Terminal name	Function description
1 - 2	Power supply input terminal	Connector for a commercial power supply
3 - 4	Output terminal	Connector for an electromagnetic clutch or brake

Dimensions



Characteristics

For Both Half-wave Rectified and Full-wave Rectified

For BEW-4W types, you can select between half-wave rectified and full-wave rectified by changing the connections of the wiring as shown in the figure at right.
These power supply devices are high Wattage and allow a wide range of voltage inputs, from low voltage to high. As a result, a wide variety of electromagnetic clutches and brakes can be handled by a single BEW-4W power supply alone.
You can either focus on the type of brake, assuming you will rewire, or conversely, handle a variety of types of brakes with a BEW-4W power supply alone.

How to Calculate Output Voltage

Output voltage = Input voltage × a (a set coefficient)

*** a (set coefficient) = 0.45: half-wave rectified/0.9: full-wave rectified**

(Ex.)

Half-wave: AC200V × 0.45 = DC90V

Full-wave: AC100V × 0.9 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on small spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

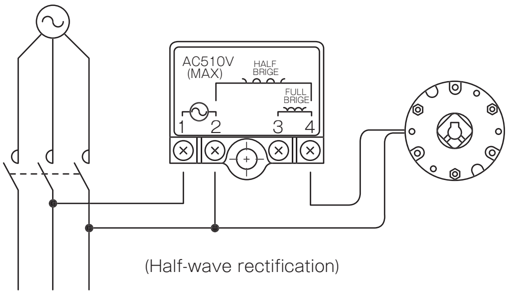
When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

How to Place an Order

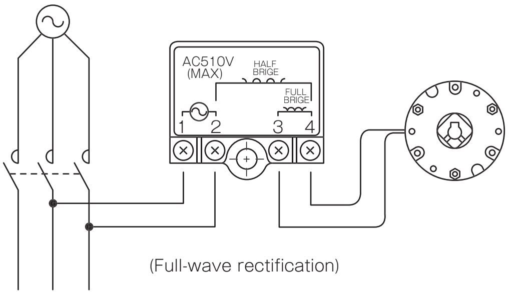
BEW-4W

Wiring Methods and Timing Charts

Primary Control

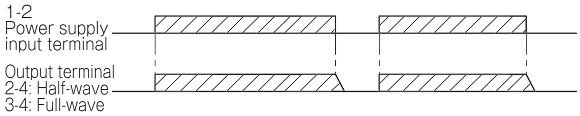


(Half-wave rectification)



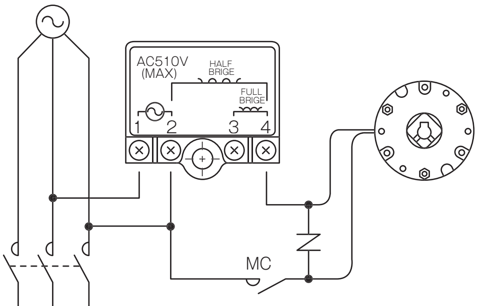
(Full-wave rectification)

Terminal no. <<Primary side control method>>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

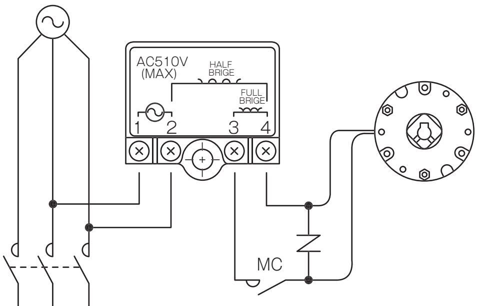


* There is no longer a surge voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control

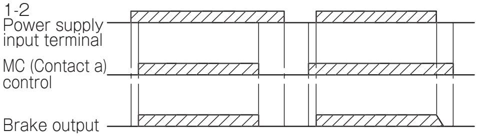


(Half-wave rectification)



(Full-wave rectification)

Terminal no. <<Secondary side control method>>
The brake output is controlled by the input power being input to the 1-2 terminals and the relay being toggled ON/OFF.

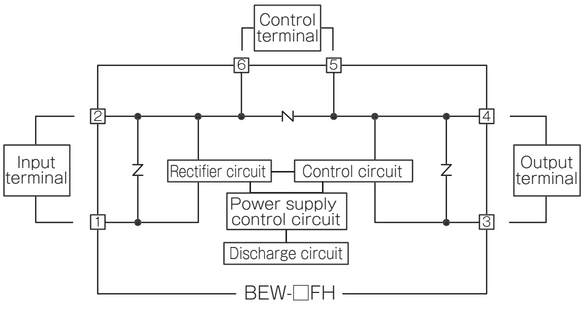


BEW-FH Types Overexcitation Supplies that Switch Between Full- and Half-wave

Specifications

Model			BEW-1FH		BEW-2FH		BEW-4FH	
Input voltage	AC100V	± 10% 50/60Hz	●					
	AC200V				●			
	AC400V						●	
	Input voltage range		AC80 ～ 130V		AC170 ～ 300V		AC80 ～ 480V	
Control method			Overexcitation (full-wave rectified) for 0.5 sec followed by constant excitation (half-wave rectified)					
			Overexcitation	Constant excitation	Overexcitation	Constant excitation	Overexcitation	Constant excitation
	Output voltage		DC90V	DC45V	DC180V	DC90V	DC360V	DC180V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.6A (DC1.3A) Constant excitation		DC1.6A (DC1.3A) Constant excitation		DC1.2A (DC1.0A) Constant excitation	
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		72W (58W) Constant excitation		144W (117W) Constant excitation		216W (180W) Constant excitation	
Size Settings	Purpose of use		Using overexcitation	Using weak excitation	Using overexcitation	Using weak excitation	Using overexcitation	Using weak excitation
	Clutch/brake rated voltage		DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
	● Applicable	01	●	●	●	●	●	
		02	●	●	●	●	●	
		03	●	●	●	●	●	
		04	●	●	●	●	●	
		05	●	●	●	●	●	
		06	●	●	●	●	●	
		08	●	●	●	●	●	
		10	●	●	●	●	●	
		12		●	●	●	●	
		14		●	●	●	●	
		16		●	●	●	●	
		18		●	●	●	●	
		20		●	●	●	●	
		25		●	●	●	●	
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger					
Dielectric strength voltage			2000 V AC, 50 Hz, 1 min.					
Usage environment	With no condensation		-20 ～ +60℃					
Mass	Per product		0.065kg					

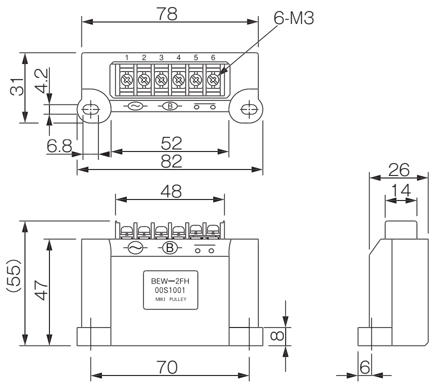
Structure



Terminals and Functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake
5-6	Control terminal	Output is controlled by opening and closing between terminals with a relay or other contact

Dimensions



Characteristics

Used as Overexcitation Supplies

BEW-FH models go through about 0.5 sec of full-wave rectified output and then transition to half-wave rectified output. BEW-FH power supply devices create an overexcitation state by matching their constant excitation voltage to the rated voltage of the electromagnetic clutch/brake to obtain the following effects.

- Longer electromagnetic clutch/brake service life (about double)
- Shorter armature pull-in time (about half) to achieve high frequency operation
- Longer service life (about double)
- Reduced startup interference by combined use of a spring-actuated brake and a motor

Also, the following effects can also be obtained by determining the specifications of the spring-actuated brake under the assumption that a BEW-FH power supply will be used.

- Higher torque
- Slimmer and more compact

Used as Weak Excitation Supplies

Conversely, BEW-FH power supply devices create a weak excitation state after armature pull-in by matching their overexcitation voltage to the rated voltage of the electromagnetic clutch/brake to obtain the following effects.

- Lower electricity consumption (about 1/4)
- Lower stator (electromagnetic coil) heat production (about 1/4)
- Shorter armature release time

Precautions for Use

Circuit Protector

These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

Primary and Secondary Control Methods

Primary control, which uses on/off of the input voltage to control electromagnetic clutches/brakes (shorting terminals 5-6), saves wiring, but makes the armature release time extremely long, so the braking time of the brake becomes long. (No surge voltage is generated.)

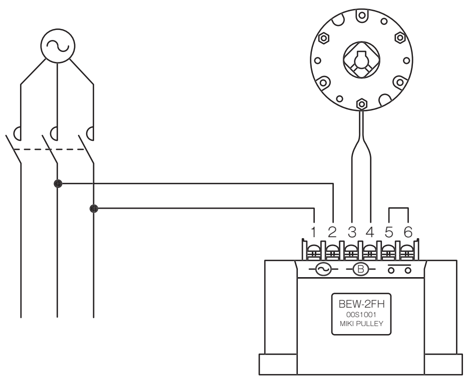
With secondary control (which controls terminals 5-6 with a relay or other contact), armature release time is shorter, as is the braking time of the brake, but there is more wiring and some surge voltages occur.

Select primary or secondary control based on the characteristics you desire.

Terminals 5-6 are part of the circuit that flows into the brake, so add voltage and current to the considerations when you select relay contacts and the like.

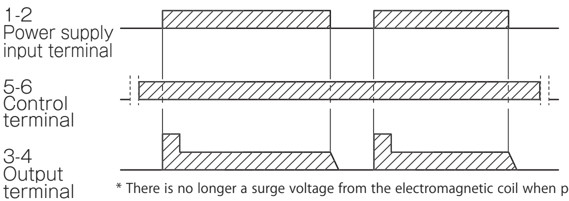
Wiring Methods and Timing Charts

Primary Control



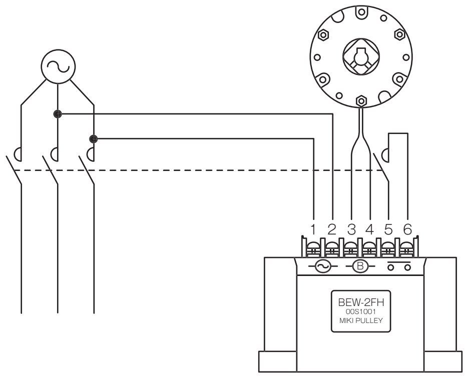
Terminal no.

<<Primary side control method>>
5-6 terminals are short-circuited and the output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.



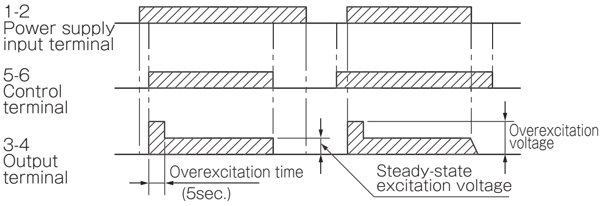
* There is no longer a surge voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control



Terminal no.

<<Secondary side control methods>>
The output from the 3-4 terminal is controlled by the input power to the 1-2 terminal being left on and the 5-6 terminal being toggled ON/OFF.



How to Place an Order

BEW-1FH

Input voltage specifications
Rated input 1: 100 V AC
Rated input 2: 200 V AC
Rated input 4: 400 V AC

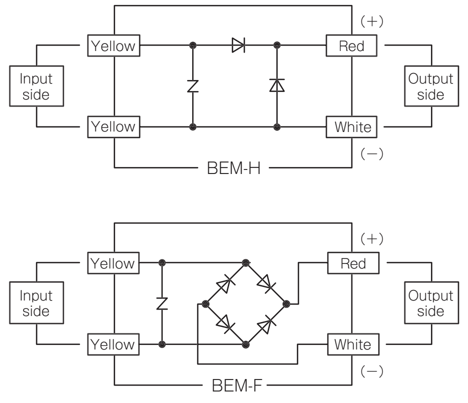
COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA
SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BES
BEH
BEW
BEW-S
BEW-W
BEW-FH
BEM
BEM-T

BEM Models Supplies with Compact Leads

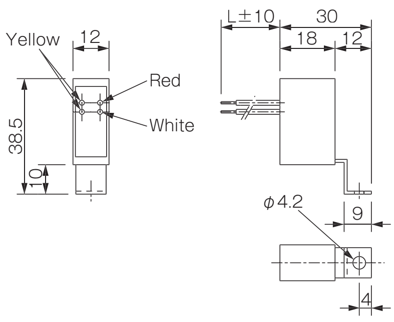
Specifications

Model			BEM-2H		BEM-4H			BEM-2F	
Input voltage	AC100V	± 10% 50/60Hz	●		●			●	
	AC200V			●		●			●
	AC400V						●		
	Maximum input voltage		AC250V		AC510V			AC250V	
Rectification method			Half-wave rectification					Full-wave rectification	
	Output voltage		DC45V	DC90V	DC45V	DC90V	DC180V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.0A (DC0.6A)		DC1.0A (DC0.6A)			DC1.0A (DC0.6A)	
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)	DC90V (AC100V)	DC180V (AC200V)
	●: Applicable △: Applicable depending on clutch/brake model	01	●	●	●	●	●	●	●
		02	●	●	●	●	●	●	●
		03	●	●	●	●	●	●	●
		04	●	●	●	●	●	●	●
		05	●	●	●	●	●	●	●
		06	●	●	●	●	●	●	●
		08	●	●	●	●	●	●	●
		10	●	●	●	●	●	●	●
		12		●		●	●	●	●
		14		●		●	●	●	●
		16		●		●	●	●	●
		18		△		△	●	△	●
		20		△		△	△	△	●
		25		△		△	△	△	●
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake						
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger						
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.		2200 V AC, 50 Hz, 1 min.			1500 V AC, 50 Hz, 1 min.	
Usage environment	With no condensation		-15 ～ +60℃						
Mass	Per product		0.020kg		0.021kg			0.023kg	

Structure



Dimensions



Terminals and Functions

Lead color	Function name	Function description
Yellow (two)	Input side	Connector for a commercial power supply
Red/white	Output side	Connector for an electromagnetic clutch or brake

Characteristics

For Both Half-wave Rectified and Full-wave Rectified

BEM-2H/4H types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large.They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
When the above are to be avoided, consider changing to a full-wave rectified supply (BEM-2F types), smoothing supply, or a DC 24 V specification.

BEM-2F types generate a full-wave rectified DC voltage. These power supply devices are known for having smaller voltage pulses than half-wave rectified supplies and tending to have little variation in electromagnetic clutch and brake operating response.

How to Calculate Output Voltage
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectified/0.9: full-wave rectified**
(Ex.)
BEM-2H, -4H: 200 V AC × 0.45 = 90 V DC
BEM-2F: AC100V × 0.9 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

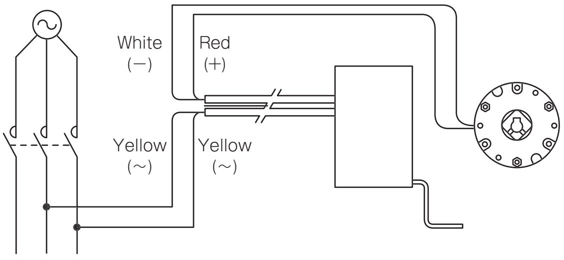
Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on smaller spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

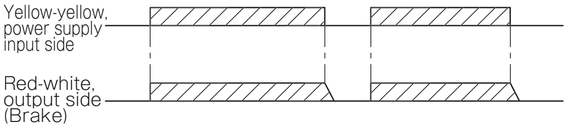
When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

Wiring Methods and Timing Charts

Primary Control

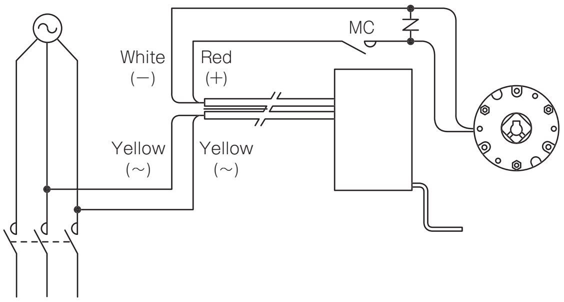


Lead wires <<Primary side control method>>
The output for the (red/white) output lead wire is controlled by the input power to the (yellow) input lead wire being toggled ON/OFF.

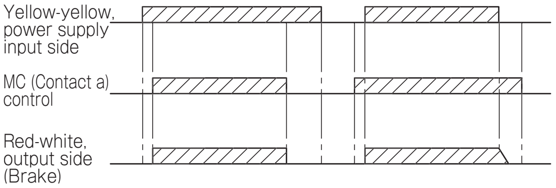


* There is no longer a counterelectromotive voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control



Lead wires <<Secondary side control method>>
The brake output is controlled by the input power being input to the (yellow) input lead wire and the relay being toggled ON/OFF.



How to Place an Order

BEM-2H 120L

Input voltage specifications
Rated input 2: 200 V AC
Rated input 4: 400 V AC

Rectification method
H: Half-wave rectification
F: Full-wave rectification

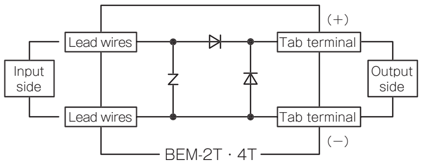
Lead wire length, three options available
120: 120 mm
240: 240 mm
360: 360 mm

BEM -T Types　Supplies with Ultra-compact Leads

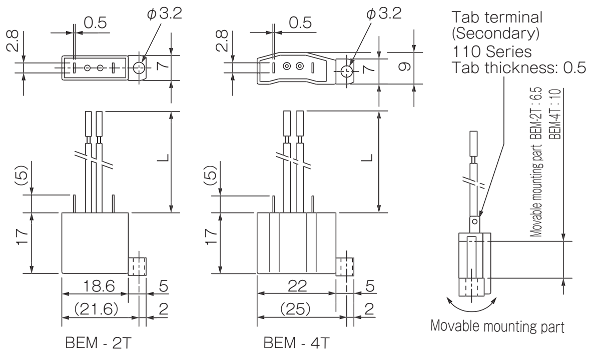
Specifications

Model			BEM-2T		BEM-4T		
Input voltage	AC100V	± 10% 50/60Hz	●		●		
	AC200V			●		●	
	AC400V						●
	Maximum input voltage		AC280V		AC480V		
Rectification method			Half-wave rectification				
Output voltage			DC45V	DC90V	DC45V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in parentheses are for an ambient temperature of 60℃		DC1.0A（DC0.6A）		DC0.7A（DC0.5A）		
Output Wattage	When the ambient temperature is 20℃ Values in parentheses are for an ambient temperature of 60℃		45W (25W)	90W (50W)	30W (20W)	60W (40W)	125W (90W)
Size setting	Voltage specifications Figures in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)
	●: Applicable △: Applicable depending on clutch or brake model	01	●	●	●	●	●
		02	●	●	●	●	●
		03	●	●	●	●	●
		04	●	●	●	●	●
		05	●	●	●	●	●
		06	●	●	●	●	●
		08	●	●	●	●	●
		10	●	●	●	●	●
		12		●		●	●
		14		●		△	●
		16		●		△	●
		18		△		△	●
		20		△		△	△
		25		△		△	△
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake				
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger				
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.		2000 V AC, 50 Hz, 1 min.		
Usage environment	With no condensation		-20 ～ +60℃				
Mass	Per product		0.008kg		0.011kg		

Structure



Dimensions



Terminals and Functions

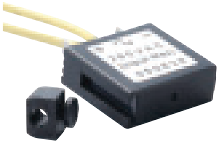
Terminal	Function name	Function description
Leads (two)	Input side	Connector for a commercial power supply
Tab terminals (two locations)	Output side	Connector for an electromagnetic clutch or brake

Recommended Products for the Tab Terminal Partner Side

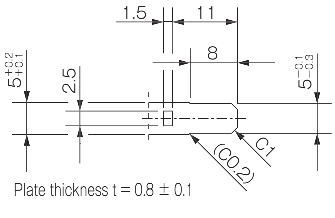
• Receptacle	170043-1	(made by AMP)
• Insulation sleeve	170823-1	(made by AMP)
• ICT insulation-covered terminal, FA type, 110 series		
• ICTDEN	280509-FA	(made by Nichifu)
• Flat insertion terminal	CSS 62853-F	(made by Nichifu)
• Insulation cap	62826-F	(made by Nichifu)

Design of Mounting Part

The standard mounting feet can not only be moved, they can be removed and a dedicated mount used. Design using the following figure as a guide or consult Miki Pulley.



Recommended mounting dimensions



Characteristics

Output System

BEM-2T/4T types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction, compact size, and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.

When the above are to be avoided, consider changing to a full-wave rectified supply (BEM-2F types), smoothing supply, or a DC 24 V specification.

How to Calculate Output Voltage

Output voltage = Input voltage × a (a set coefficient)

*** a (set coefficient) = 0.45: half-wave rectification**

(Ex.)

BEM-2T: AC200V × 0.45 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.

This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.

This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on smaller spring-actuated brakes.

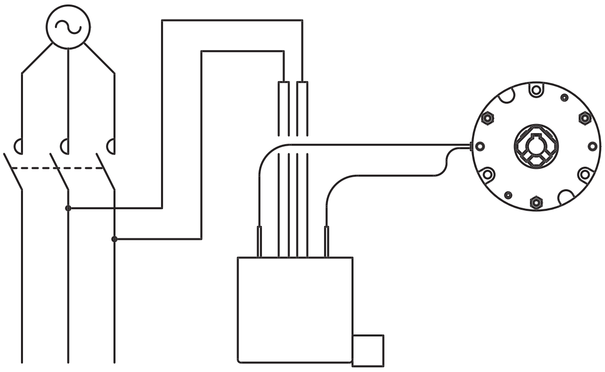
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.

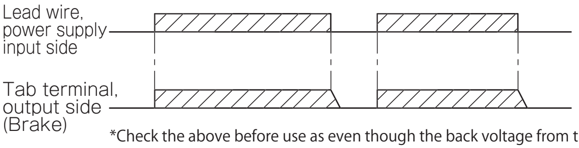
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

Wiring Methods and Timing Charts

Primary Control

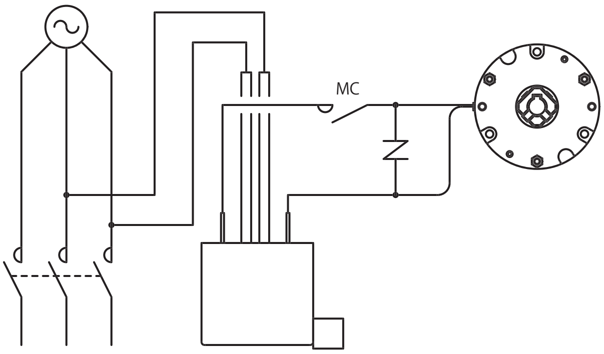


<<Primary side control method>>
The output for the tab terminal on the output side is controlled by the input power to the input lead wire being toggled ON/OFF.

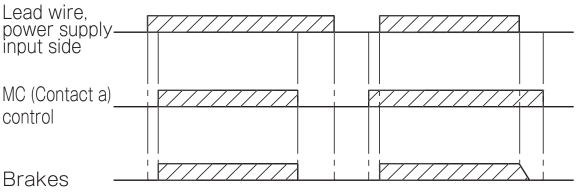


*Check the above before use as even though the back voltage from the electromagnetic coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increse.

Secondary Control



<<Secondary side control method>>
The brake output is controlled by the input power being input to the input lead wire and the relay being toggled ON/OFF.



How to Place an Order

BEM-2T 120L

Input voltage specifications
2T: 200 V AC
4T: 400 V AC

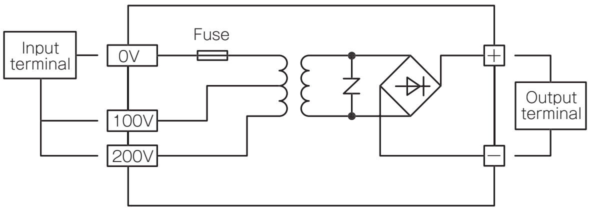
Lead wire length, three options available
120: 120 mm
240: 240 mm
360: 360 mm

Types of Power Supply Devices

Power supply devices are necessary for electromagnetic clutches and brakes to operate. MIKI PULLEY's electromagnetic clutches and brakes all use DC power supply coils, so commercial power supplies must be converted to DC voltages by any one of a variety of methods and that voltage then supplied to the clutch or brake.
There are many ways to create a DC power supply voltage. The operating characteristics of the electromagnetic clutch and brake are greatly affected by the type and specifications of that power supply device.

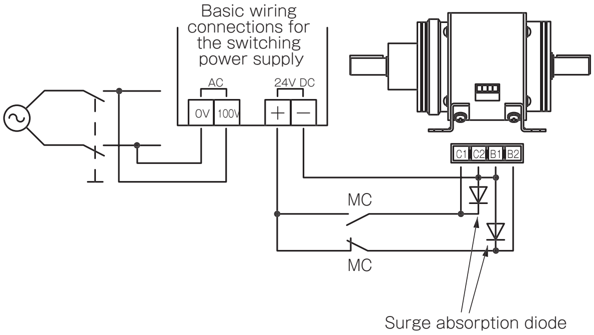
Transformer Stepdown/Single-phase Full-wave Rectified System

This is the most commonly used system for power supplies for electromagnetic clutches/brakes. This system is used with DC 24 V electromagnetic clutches/brakes, has a simple, sturdy construction, and has major resistance to surge voltages (counterelectromotive voltage) that are produced when electromagnetic clutches/brakes are turned on or off, making this a rectification system that is very easy to work with.



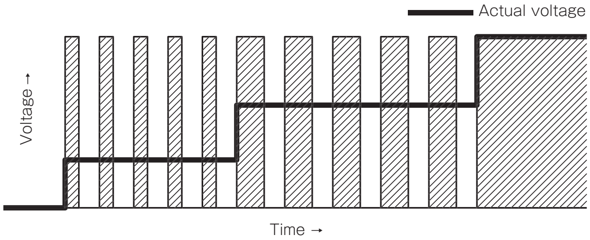
Switching Power Supplies (Off-the-shelf)

These are widely used as power supplies (usually DC 24 V) for relays, timers, programmable controllers, and a variety of other electrical equipment. They are light, compact power supply devices that generate smoothed, stable voltages.
However, these power supplies are characteristically vulnerable to surge voltages generated when electromagnetic coils like those found in electromagnetic clutches and brakes turn on and off. Manufacturers of switching power supplies do not guarantee them for use in such applications.
If you are using a switching power supply as the power supply device for an electromagnetic clutch or brake, you must connect a diode to serve as a surge absorber in parallel to the electromagnetic coil.
Surge absorbing diodes dramatically lengthen the armature release time, so care is advised in their use.



The PWM Control System

Repeatedly turning energization on and off is a system that creates a simulation of a given voltage as the effective value. Compared to the wasting of surplus electrical energy as heat in resistance control or the like, PWM control saves energy by turning energization on and off at high speed with control elements to get only the power needed, meaning that energy is not wasted as heat.

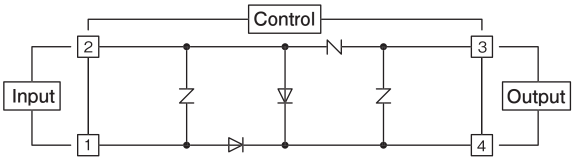


Half-wave Rectified Supplies (BEW and BEM Models)

Half-wave rectified power supply devices are circuits that contain two diodes, take commercial power supplies as direct input, and generate half-wave rectified DC voltage on the output side.
These power supply devices have very simple circuit structures compared to other power supply devices, and they are compact and low cost.
However, they produce variations of around 10 ms in electromagnetic clutch/brake operation due to the energizing system, which repeatedly starts and stops in a cycle of half of 50/60 Hz, the frequency of commercial power supplies. They are also prone to producing a howling noise when they are energized, and tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
This means they can be used when these trends will not have a major impact, in the event they occur. Miki Pulley recommends the use of half-wave rectified supplies in combination with spring-actuated brakes.
When variations in operation, howling noise when energized, and the like are to be avoided, consider changing to a full-wave rectified supply (BEW-1R/2R/4R types) or a DC 24 V specification.

Calculating the Output Voltage from a Half-wave Rectified Power Supply

Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectification**
(Ex.)
AC100V × 0.45 = DC45V
AC200V × 0.45 = DC90V
AC400V × 0.45 = DC180V



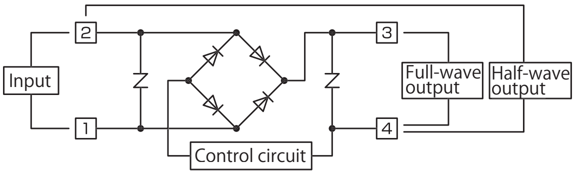
BEW-2G/4G

Full-wave Rectified Supplies (BEW and BEM Models)

Full-wave rectified power supply devices are circuits that contain four diodes, take commercial power supplies as direct input, and generate full-wave rectified DC voltages on the output side.
These power supplies are somewhat more expensive than half-wave rectified supplies, since they use more diodes to construct circuits, but they keep voltage pulses low, so they can suppress variation in electromagnetic clutch/brake operating times.
They can therefore be used as power supply devices for all electromagnetic clutches and brakes.

Calculating the Output Voltage from a Full-wave Rectified Power Supply

Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.9: full-wave rectification**
(Ex.)
AC100V × 0.9 = DC90V
AC200V × 0.9 = DC180V



BEW-1R/2R/4R

Overexcitation Supplies (BES, BEH, and BEW-FH Models)

Overexcitation power supplies are power supply devices that apply and control voltage above the rated voltage for a certain set period of time with the goal of speeding up the armature pull-in time of electromagnetic clutches and brakes, boosting the torque generated, and lengthening service life (electromagnetic-actuated clutches/brakes).

By using these power supplies, the above described electromagnetic clutch and brake characteristics are notably improved.

Caution is advised, however, because if the conducting frequency and time of the electromagnetic clutch/brake are not set appropriately, the coil of the electromagnetic clutch/brake will generate abnormal heat, potentially leading to damage.

Reverse Excitation Function (BEH Models)

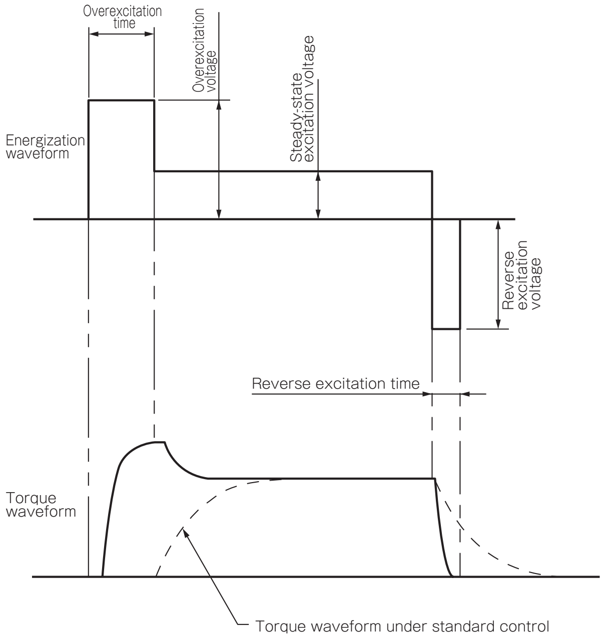
The reverse excitation function is a conductance system that, when energization to the electromagnetic clutch/brake is turned off, applies and controls, for a certain set period of time, a voltage of opposite polarity to the voltage just prior to energization going off, with the goal of shortening the armature release time of electromagnetic clutch/brake.

These power supply devices are more effective the larger the electromagnetic clutch or brake is. With our clutch/brake size 25, it achieves five times the responsiveness of an ordinary transformer stepdown/single-phase full-wave rectified system.

This is a big help in improving high-frequency operation and fighting phenomena.

* MIKI PULLEY overexcitation power supply devices are pre-set to optimal values.
They are pre-set to the optimal value for the given size of MIKI PULLEY electromagnetic clutch or brake, so no special adjustments are needed when installing. If you are not combining the power supply with a MIKI PULLEY electromagnetic clutch/brake, these are not optimal value conditions. Please consultMiki Pulley.

* BEH models are smoothing overexcitation power supply devices.
BEH models, which are smoothing power supplies, have very stable electromagnetic clutch/brake operating response characteristics compared to non-smoothed supplies.



Weak Excitation Supplies (BES and BEW-FH Models)

In recent years, the dimensions of electromagnetic coils and structural components have become more complex and capacities larger to meet demands for spring-actuated brakes that are more compact, slimmer, and provide higher torque.

Directly opposing societal demands for greater energy savings, greater recyclability, and avoidance of toxic materials have meanwhile created a challenging environment for electromagnetic clutches and brakes.

Spring-actuated brakes by their nature require a strong attraction force when the armature is being pulled in, but once they are pulled in, can be held in place with only a tiny amount of power.

Power beyond that required to maintain the spring-actuated brake in a released state can be considered wasted power; spring-actuated brakes waste very large amounts of such power.

Weak excitation power supplies remedy this problem of spring-actuated brakes and achieve the following sorts of effects.

Miki Pulley can design many types of both spring-actuated brakes and power supply devices to resolve such problems. Do not hesitate to consult us.

■ Compact, slim, high torque, high responsiveness, and long service life

A compact, slim, high-torque, and highly responsive spring-actuated brake with a long service life is achieved by designing the brake assuming that it will use a weak excitation power supply.

■ Energy saving

By creating a weak excitation state, they cut ordinary power by more than 90% while similarly reducing heat generated by electromagnetic coils by more than 90%.

■ Reducing the fault rate

They dramatically reduce burning of spring-actuated brakes caused by abnormal heat generation in electromagnetic coils or rises in ambient temperature, as well as burning in the periphery of spring-actuated brakes.

■ Increasing recyclability

They can be broken down into their constituent raw materials, increasing the recyclability of structural components.

Control of Electromagnetic Clutches and Brakes

Power supply devices are what is required to make electromagnetic clutches and brakes work, but control devices are necessary for freely controlling electromagnetic clutches and brakes consistent with machinery operation, so this portion must be installed separately.
Miki Pulley's BEH models, which are high-performance power supplies, get minute control input from programmable controllers or the like and perform high-Wattage energization control.
However, other power supply devices are constructed so that the power applied to the electromagnetic clutches and brakes is applied unaltered to control contacts or the like, meaning that power relays and other power control equipment is needed for control.
Each piece of control equipment has its own features, so those features must be adequately studied and control equipment selected that is matched to the machinery specifications.

Power Relays (Off-the-shelf)

There are relays that can control relatively large currents up to 10 A, which are generally called power relays.
These relays guarantee power control of high voltage and current values for AC power supplies, but in DC power supply control, they must be used within extremely low specification value ranges when the load is a DC inductive load.
This is because relay contacts are heavily worn by surge voltage (counterelectromotive voltage) generated during electromagnetic coil control. Since electromagnetic clutches and brakes have electromagnetic coils, check the catalog specification values at the conditions of the DC inductive load of the power relay you will use.
General guideline values are given below.

For LY series, made by Omron

Primary Control of Electromagnetic Clutches and Brakes

AC voltage: AC 110 V (no more than the maximum AC 250 V)
AC current: AC 4 A max.
Wattage: 100W max.

Secondary Control of Electromagnetic Clutches and Brakes

DC voltage: DC 24 V (no more than the maximum DC 125 V)
DC current: DC 1 A max.
Wattage: 25W max.

* Secondary control values are for when a MIKI PULLEY varistor is used.
* The above values must be within the specification value ranges for all three items.
* For primary and secondary control, see the control wiring of the individual model of power supply.
* When diodes are used as discharge elements, the specification values of primary control are allowed even with secondary control.

Electromagnetic Contactors (Off-the-shelf)

Electromagnetic contactors and electromagnetic switches, which are widely used in control of induction motors and the like, are very effective as control equipment for controlling large electromagnetic clutches and brakes.
These electromagnetic contactors can control several times as much voltage and current as power relays, and are particularly effective in high-voltage control.
Electromagnetic contactors are suited to high-power control, but a discharge element such as a varistor must be added for surge voltages (counterelectromotive voltages) generated when controlling electromagnetic clutches and brakes.
Were one to control a large electromagnetic clutch or brake without using a discharge element, the surge voltage generated might exceed 2000 V. This voltage easily exceeds the rated voltage of the electromagnetic contactor, ultimately greatly wearing the contacts, which is likely to prevent the equipment from having its expected service life.
General guideline values are given below.

For SC series, made by Fuji Electric

Primary Control of Electromagnetic Clutches and Brakes

AC voltage: AC 220 V (no more than the maximum AC 440 V)
AC current: AC 3 A max.
Wattage: 450 W max.

Secondary Control of Electromagnetic Clutches and Brakes

DC voltage: DC 220 V max.
DC current: DC 2 A max.
Wattage: 150W max.

* Secondary control values are for when a MIKI PULLEY varistor is used.
* The above values must be within the specification value ranges for all three items.
* For primary and secondary control, see the control wiring of the individual model of power supply.
* When diodes are used as discharge elements, the specification values of primary control are allowed even with secondary control.

Solid State Relays/SSR (Off-the-shelf)

SSRs used in control of the various load devices are highly suited to control by programmable controller. In recent years, their use has continued to grow. Most SSRs are intended for control of AC supplies; 80% of SSRs on the market are for AC power supply control.
When using an AC control SSR for an electromagnetic clutch/brake, the input voltage (which is the primary side of the power supply device) is controlled.
The "zero cross control" used in SSR control slows response when used with primary control, so be careful when using it with electromagnetic clutches and brakes.

Maximum rated voltage is a very important specification with DC supply control SSRs.
When controlling an electromagnetic clutch or brake with a DC SSR, the surge voltage generated must be kept within the SSR rating. In other words, a discharge element such as a varistor or diode must be used.
If no discharge element is added, the SSR will be damaged in a short time. For details, contact the SSR manufacturer or Miki Pulley.

Contactless Control (Power MOS-FET/Power Transistor)

The major goals of contactless control of electromagnetic clutches and brakes are high-frequency operation and high-precision operation.

Such control is suited to cases in which delay of output vis-a-vis input signals, as happens with control using contacts, is undesirable. It offers major advantages such as the doing away with the need for wear-related maintenance and the ability to make devices smaller by making a control board.

Although contactless control has these many advantages, caution is advisable when selecting elements. Should a selection be made badly, not only will the electromagnetic clutch or brake not deliver the desired characteristics, the elements will be damaged in a short period of time, and peripherals could even be affected.

The following serves as a general guide for selecting elements.

Control of selection example 101-12-13 and an ordinary switching supply

Conditions

- **Clutch used: 101-12-13**
- **Rated voltage: DC 24 V**
- **Rated current: DC 1.09 A**
- **Varistor used: 82 V varistor (TNR7V820K)**

Elements selected

- **Rated voltage: 200 V min.**
- **Rated current: 5 A min.**

■ Key selection issues

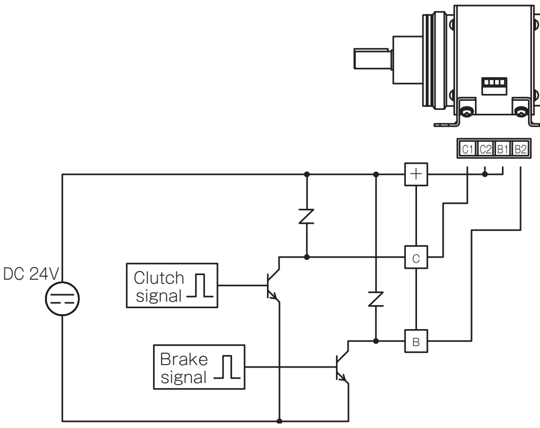
The rated voltage of the element must be at least the highest voltage applied to the element.

In the above example, the surge voltage generated when the electromagnetic clutch or brake is controlled by on/off is the highest value.

Varistors have variation in clamping voltages due to their operating characteristics, and a maximum clamping voltage is defined. Under these element conditions (82 V elements), that value is 135 V.

A safety factor for this voltage is required for the element. With a minimum safety factor of 1.3, 135 V × 1.3 = 175.5 V. Thus, the rated voltage of the element must be at least 200 V.

The rated current of the element must be at least three times the current value actually flowing. Also, the amount of heat generated by the element varies considerably with the type of element selected, energizing conditions, and ambient environment. In the end, evaluate the heat generation of the element under usage conditions, and check whether the amount of heat generated is within the specified value range of the element.



Other Control

■ Current control (electromagnetic-actuated clutches and brakes)

This control system is intended for torque control of electromagnetic clutches and brakes.

Electromagnetic clutches and brakes generate attraction force using the current flowing into the electromagnetic coil and transmit torque using that attraction force. The value of the current flowing into the electromagnetic coil must therefore be controlled in order to control torque.

Miki Pulley offers power supply devices for performing this current control. Feel free to consult Miki Pulley.

■ Voltage control

There are many different purposes to voltage control, and many different ways to implement that control. All of the following are voltage controls.

- Weak excitation control
  Simple torque control (using voltage regulation)
  Softens shocks upon engagement
  Speeds up armature release
  Suppresses heat generation in electromagnetic coils
- Overexcitation control
  Shortens armature pull-in time
  Boosts torque
- Rapid excitation control
  Shortens armature pull-in time
- Rapid overexcitation control
  Shortens armature pull-in time
  Boosts torque

To implement the control described above, the power supply voltage must be set to a prescribed state and some kind of control performed.

- Switching control, preparing several types of supply voltage
- Control of voltage using knob
- Switching control without using contacts
- Voltage control that inserts resistors in series to divide voltage

■ Rapid excitation control

This is a circuit that makes the time constant smaller to speed up the armature pull-in time of the electromagnetic clutch or brake.

The circuit places resistors in series with the electromagnetic clutch/brake and pre-sets the power supply voltage high. The supply voltage and the resistance values are set according to various conditions so that DC 24 V, which is the rated voltage, is applied to the electromagnetic coil.

This control method requires that a current similar to the current value flowing to the electromagnetic clutch/brake also flow to the resistors and that the resistance Wattage be set high. The heat generated by the resistors must also be considered.

* Time constant
The time constant exhibits the characteristic that the value of the current flowing inward gradually rises as DC voltage is applied, since the electromagnetic clutch or brake is an inductive load.
This characteristic has a value determined by the type and size of the electromagnetic clutch or brake, such that the larger the object, the slower the current movement becomes.

■ Rapid overexcitation control

The armature pull-in time can be made even shorter than with rapid excitation control by adding a large capacitor to the rapid excitation circuit.

An overexcitation voltage is generated by the capacitor, so the on/off times must be set factoring in the heat generated by the electromagnetic coil and the time to charge the capacitor.

Surge Voltages and Discharge Elements

What is Surge Voltage?

When current flows to the electromagnetic coil of an electromagnetic clutch or brake, the coil is excited, the pull-in force required by the clutch or brake is generated, and work is performed.

Energy is accumulated within the coil, which has reached the prescribed current value; the larger the clutch or brake size, the larger is the amount of that energy. At this time, if current is shut off, a surge voltage of only part of the accumulated energy is generated. This is generated by working to keep current flowing, since the electromagnetic clutches and brakes are inductive loads. Surge voltages are larger with larger sizes, as noted above, and voltages easily exceeding 1000 V are generated in control contacts and within electromagnetic coils. This phenomenon can cause contact burning or electromagnetic coil insulation breakdown. It is thus very important to use discharge elements to limit this surge voltage to an appropriate value.

In general, a high surge-limit voltage means a short armature release time; conversely, a low limit voltage tends to mean a longer time. When selecting a circuit protector, it is very important to factor in machinery specifications, power supply device/control circuit conditions, and the like.

The Role of Varistors

We recommend using a varistor for the discharge element.

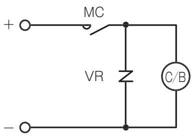
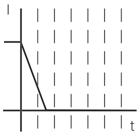
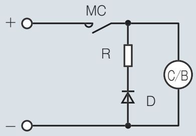
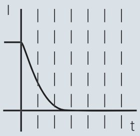
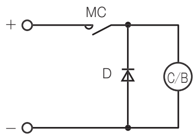
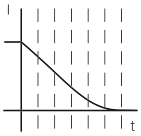
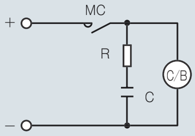
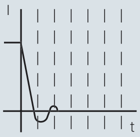
The reason is that it is easy to set the limit voltage needed for the varistor to appropriately control the electromagnetic clutch/brake; the element is also very small and can adequately handle different amounts of surge energy.

By selecting an appropriate varistor, the electromagnetic clutch/brake can be used without impairing innate characteristics.

When the selection has an inappropriately high limit voltage, control contact may be burned or the power supply device damaged.

Conversely, when the limit voltage is too low, the varistor may be burned by the power supply device or the power supply device may be damaged. Also, even when such phenomena do not occur, the armature release time is prone to becoming long.

Types of Discharge Elements

Element type	Circuit diagram	Current decay	Characteristics	Clutch/brake		Recommended product
				Size	Rated voltage (input voltage specification)	
Varistor			Very effective in keeping surge voltage small without adding delay to the armature release time.	Electromagnetic-actuated #02 to #25	DC24V	NVD07SCD082 or an equivalent (NVD14SCD082 or an equivalent)
				Electromagnetic-actuated #31 or over	DC24V	NVD14SCD082 or an equivalent
				Spring-actuated #01 to #18	DC24V	NVD07SCD082 or an equivalent
					DC 45 V (AC 100 V - half-wave rectified)	NVD07SCD220 or an equivalent
					DC 90 V (AC 100 V - full-wave rectified)	
					DC 90 V (AC 200 V - half-wave rectified)	NVD07SCD470 or an equivalent
					DC 180 V (AC 200 V - full-wave rectified)	
					DC 180 V (AC 400 V - half-wave rectified)	NVD14SCD820 or an equivalent
				Spring-actuated #20 or over	DC24V	NVD14SCD082 or an equivalent
					DC 45 V (AC 100 V - half-wave rectified)	NVD14SCD220 or an equivalent
					DC 90 V (AC 100 V - full-wave rectified)	
					DC 90 V (AC 200 V - half-wave rectified)	NVD14SCD470 or an equivalent
					DC 180 V (AC 200 V - full-wave rectified)	
					DC 180 V (AC 400 V - half-wave rectified)	NVD14SCD820 or an equivalent
Resistor + Diode			Can keep power consumption of the power supply part low and resistor Wattage low. The armature release time becomes somewhat longer, so care is required in high frequency use.	#01 to #25	DC24V	☐ Rated voltage of diode • DC 24 V: 100 V min. • AC 100 V: 400 V min. • AC 200 V: 800 V min. ☐ Rated current of diode • Specification of excitation current or more ☐ Resistance • About 10 times coil resistance
					DC 45 V (AC 100 V - half-wave)	
					DC 90 V (AC 100 V - full-wave)	
					DC 90 V (AC 200 V - half-wave)	
					DC 180 V (AC 200 V - full-wave)	
Diode			While the effect in suppressing surge voltage is very high, the armature release time becomes extremely long. Pay attention to high-frequency specifications and fighting between clutches and brakes.	#01 to #25	DC24V	☐ Rated voltage of diode • DC 24 V: 100 V min. • AC 100 V: 400 V min. • AC 200 V: 800 V min. ☐ Rated current of diode • Specification of excitation current or more
					DC 45 V (AC 100 V - half-wave)	
					DC 90 V (AC 100 V - full-wave)	
					DC 90 V (AC 200 V - half-wave)	
					DC 180 V (AC 200 V - full-wave)	
Resistor + Capacitor			Although armature release time becomes very short, a high-breakdown-voltage capacitor must be used and the device becomes large.	#01 to #25	DC24V	Capacitor C [μ F]: Ratio to contact current is: $\frac{C\,[\mu F]}{I\,[A]} = \frac{0.5 \sim 1}{1}$ Breakdown voltage: 600 [V] Resistance R [Ω]: Ratio to contact current is: $\frac{R\,[\Omega]}{E\,[V]} = 1$ Wattage = 1 [W]
					DC 45 V (AC 100 V - half-wave)	
					DC 90 V (AC 100 V - full-wave)	
					DC 90 V (AC 200 V - half-wave)	
					DC 180 V (AC 200 V - full-wave)	

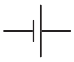
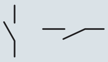
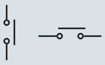
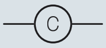
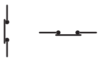
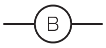
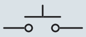
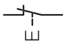
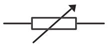
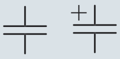
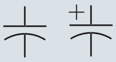
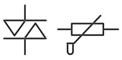
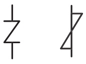
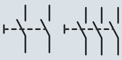
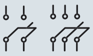
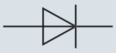
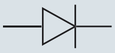
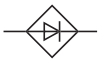
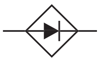
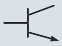
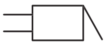
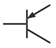
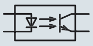
* Some spring-actuated brakes come with varistors other than those recommended above, depending on size.

* Recommended varistors with NVD☐ model names are made by KOA. Items in parentheses are the products that can be used.

Symbols Used in Electrical Circuits

Figure Notations

With rapid advances in science and technology, many new codes and symbols have been adopted in drawings. The drawing symbols below have been created based on JIS handbooks and code and on drawing symbol handbooks primarily for machinery and elements that have long been widely used. The IEC standard or commonly used symbol is labeled Symbol 1; previously used symbols are labeled Symbol 2,

Name	Symbol		Name	Symbol	
	Symbol 1 (IEC or equivalent)	Symbol 2 (old symbol)		Symbol 1 (IEC or equivalent)	Symbol 2 (old symbol)
DC power supply			Motor		
AC power supply			Induction motor		
Fuse			Generator		
Relay a-contact			Electromagnetic clutch		
Relay b-contact			Electromagnetic brake		
Pushbutton switch a-contact			Clutch or Brake		
Pushbutton switch b-contact			Transformer		
Limit switch a-contact			Resistor		
Limit switch b-contact			Variable resistor		
Timer (ON delay) a-contact			Capacitor		
Timer (ON delay) b-contact			Varistor		
Knife switch			Diode		
Magnetic contactor			Rectifier (bridge type)		
Lamp			Transistor (NPN type)		
Buzzer			Transistor (PNP type)		
Ground			Photocoupler		
Connect to outer case			Coil		

* This catalog uses the symbols that are currently the most common in its figures.